

XIII. — HYDNOCARPUS, TARAKTOGENOS, AND
ASTERIASTIGMA FROM BURMA. C. E. C. FISCHER.

Notes on several species of Flacourtiaceous plants, the seeds of which yield Chaulmoogra oil, were published in *Kew Bulletin* 1926, p. 17 and 1927 p. 49. Recently a series of 60 dried specimens of such species has been received from Mr. C. E. Parkinson, Forest Botanist, Burma, for determination in connection with an enquiry into the oil value of the seed. These proved to belong to four distinct species, of which one (represented by a single specimen without flowers and only some pieces of the epicarp of the fruit) could not be identified. The other three belong to three separate genera: *Hydnocarpus*, *Taraktogenos* and *Asteriastigma* (united by Warburg under *Hydnocarpus* in *Pflanzenreich* III. 6a. 21). The affinities of these plants, which, indeed, have many obvious points of resemblance, are recognised by the Burmese, for all three are named *Kalaw* with or without qualifying suffix.

***Hydnocarpus anthelmintica* Pierre** is now recorded for the first time outside Siam and Cambodia. The five specimens sent were collected with flowers in the month of April in the Myitkyina District in Northern Burma at an elevation of about 550 feet. The flowers are said to be fragrant and the bark and root to be used medicinally. The local name is *Kalaw*.

***Taraktogenos Kurzii* King.** All but thirteen of the specimens are this species, which was first described by King in 1890 (*Jour. As. Soc. Bengal* lix. ii. 123) as from Burma and Chittagong. The specimens under consideration were collected in various parts of Burma at varying elevations:

Myitkyina District, 900 ft., fl. June, bark brownish-grey with white patches, vernacular name 'Kalaw-sai.'

Insein District, fl. Ap. and Nov., a tree 30 ft. high, vernacular name 'Kalaw.'

Mawlaik (Upper Chindwin) District, 500-600 ft., fl. Ap. to July, fr. May, evergreen tree 40-70 ft. high in evergreen forest; new leaves appearing just prior to or during flowering; seeds 14-19, pulp edible when ripe, vernacular name 'Kalaw' or 'Kalaw-thein.'

Tenasserim District, West of the Dawna Hills, 3000 ft., fl. Mar., vernacular name 'Kalaw-na,' 'Kalaw-ni' or 'Kalaw-pyu.'

There are slight differences in the size of leaves, in the amount of pubescence of the flowers, especially on the filaments of the stamens and staminodes, and the size of the fruit, but these are inconstant and do not indicate even local varieties.

As the present specimens offer a wider range than was available at the time of the original description and also contain ♀ flowers which were then unknown a note on the variations and a description of the ♀ flowers seem desirable.

In the specimens from Tenasserim some of the ♂ pedicels are unusually long, attaining 0.6 in. The stamens vary in number from 15-29 and also in the amount of pubescence, but are always more or less pubescent, this applies also to the amount of indumentum in other parts of the flowers. The fruit varies from 2.25 to 4 inches in diameter.

Female flower 0.6 in. in diam. *Sepals* 4, very shortly united at the base, suborbicular, concave, more or less rusty puberulous without, glabrous within, usually minutely ciliate, at least apically. *Petals* 8, smaller than the sepals, unequal, rotund, glabrous, ciliate with long crisped whitish hairs, each with a fleshy densely hairy and ciliate scale about $\frac{2}{3}$ its size attached to the base of its inner face. Some of the petals or scales often more or less connate in pairs or threes (this applies also to the ♂ flowers). *Staminodes* 10-14, nearly as long as the ovary, sometimes shortly connate at the base; filaments long, more or less densely white crisped-hairy, all bearing broadly sagittate anthers devoid (always?) of pollen. *Ovary* globose or ellipsoid, densely rufous-tomentose, 1-celled, ovules numerous on 3 parietal placentas, style very short or 0; stigmas 3-5; stellately spreading, flabelliform, 2 or more lobed at the apex.

Asteriastigma macrocarpa Bedd. The remaining specimens are of this species, which was originally described by Beddome (Flora Sylvatica t. 266) from specimens obtained in the Travancore Hills of Southern India and until 1926 had not been reported from elsewhere. In the latter year Mr. Parkinson sent specimens from the Myitkyina District and when determining them a similar specimen without flowers was found in the Kew herbarium which had been sent in 1921 by Mr. R. S. Hole from the Hukong Valley.

The present specimens are as follows:—

Mawlaik (Upper Chindwin) District, 1000 ft., fl. and fr. June, tree 70 ft. high confined to evergreen forest; fruit 5-7 in. in diam., seeds 42-49, vernacular name 'Kalaw-ma' or 'Kalaw-chaukse.'

Hkamti State District, 1200 ft., fl. June, moderate to big evergreen tree confined to evergreen forest, vernacular name 'Kalaw-ma' or 'Kalaw-chaukse.'

Myitkyina District, 500-600 ft., fl. and fr. Feb., tree 40 ft. high, vernacular name 'Kalaw-ni.'

All these localities (including the Huking Valley) adjoin each other in the North of Burma.

Beddome described the flowers as hermaphrodite, and though they may be so occasionally it is probable that the stamens of the ♀ are rarely polleniferous. As the original description is limited a fuller one is here supplied.

Asteriastigma macrocarpa Bedd. a moderate sized to large tree, shoots densely aureo- or rusty-pubescent. *Leaves* narrowly to broadly oblong, abruptly acutely cuspidate, base rounded or somewhat narrowed, slightly unequal, up to 14 in. long and 5 in. wide, glabrescent above (always somewhat rusty-pubescent at least near the base on the rib and nerves), brown and furnished with minute white dots below and rusty strigose-pubescent on the rib and nerves which are very prominent, primary nerves 7-10 on either side, usually 1 more on one side than on the other, regular, ascending, secondary nerves raised, regular, parallel, transverse between the primaries, ultimate reticulations fine but distinct; petioles 0.5-0.9 in. long, rusty-pubescent. *Flowers* fascicled or in short cymes (up to 2 in. long) on the older branches; rachis stout, rusty-pubescent; pedicels short, rusty-pubescent. *Buds* globose. *Flowers* ♂ about 1 in. in diam. *Sepals* 4, imbricate, coriaceous, orbicular, concave, minutely ciliate, about 0.4 in. long. *Petals* 12, smaller than the sepals, suborbicular, unequal, glabrous, ciliate, each furnished with a thick, rufous-tomentose scale about $\frac{1}{2}$ of its size attached to the base. *Stamens* 50-60, quite glabrous; filaments long, somewhat flattened; anther large, oblong-cordate to broadly-sagittate, basal lobes rounded. *Rudimentary pistil* ovoid, shorter than the filaments, densely rufous-tomentose. *Flowers* ♀ about 1.2 in. in diam. *Sepals* 4, orbicular, concave, 0.5-0.6 in., in diam., inner 3 at least minutely ciliate. *Petals* 12, suborbicular or obovate, much smaller than the sepals, glabrous, fringed with long fuscous silky hairs, each with a thick densely fuscous or rufous silky-tomentose scale about $\frac{2}{3}$ its size attached to its base. *Staminodes* 45-60, glabrous, filaments long, all with small cordate or sagittate anthers. *Ovary* globose, densely fuscous or rufous silky-tomentose, 1-celled, ovules many; style very short or 0; stigmas 6-8, stellately spreading, coriaceous, large, flabelliform, apex deeply 2-lobed, lobes rounded, glabrous above, densely fuscous or rufous silky-tomentose below. *Berry* globose, 5-7 in. in diam., pubescent, pericarp woody, fibrous, 0.4-0.6 in. in diam. (when dry); seeds numerous, embedded in pulp, oblong-ovate, more or less angled by compression, about 1.3 in. long.

The number of sepals and petals in each of the three genera mentioned appears to be constant (5 each in *Hydnocarpus*, 4 sepals and 8 petals in *Taraktogenos*, 4 sepals and 12 petals in *Asteriastigma*) and it seems, therefore, quite justifiable as well as more convenient to maintain them rather than merge them in *Hydnocarpus*.

XIV.—CONTRIBUTIONS TOWARDS A PHYLOGENETIC CLASSIFICATION OF FLOWERING PLANTS: VI.*

J. HUTCHINSON.

A. THE GENERA OF HYDRANGEACEAE. By J. HUTCHINSON.

B. THE GENERA OF SAXIFRAGACEAE (p. 107). By J. E. DANDY.

In my preliminary paper† on a proposed new classification of the dicotyledonous plant-families, and also in my recent book‡, I pointed out the desirability of segregating the "Saxifragaceae" of Bentham and Hooker's *Genera Plantarum* into several families. It was shown that the true *Saxifragaceae*, as typified by *Saxifraga* and allied genera, were entirely *herbaceous*, whilst the remaining groups were almost wholly *woody*. These woody groups, the *Cunoniaceae*, *Escalloniaceae*, *Grossulariaceae*, and *Hydrangeaceae*, to which were added the *Brunelliaceae* and *Greyiaceae*, were associated to comprise the new order *Cunoniales*, which in general showed considerable affinity with *Dilleniaceae*, and which might conceivably have been derived from the same basal stock as that family. It was postulated that the *Cunoniales*, as so constituted, had no real close phylogenetic affinity with the *Saxifragales*, but that the apparent relationship was due to parallelism which had resulted in the evolution of a somewhat similar floral type.

The *Cunoniales*, with the possible exception of part of *Hydrangeaceae* (see p. 103), have probably been derived from ancestors which were also woody, e.g. from the phylum whose basal stock is *Magnoliaceae*, and the *Saxifragales* from herbaceous ancestors such as *Ranunculaceae*. This view receives considerable support from the fact that in the *Saxifragaceae*, as here defined, there is the same tendency towards the development of commissural stigmas as there is in the *Papaveraceae* (see p. 112), a family generally regarded as having also been derived from *Ranunculaceae*. The *Saxifragaceae*, as so restricted, are a smaller, more homogeneous, and apparently very ancient family, which has probably not been the centre of much further development.

In the present contribution I have had the valuable co-operation of my colleague Mr. J. E. Dandy, who has made a very careful morphological and geographical study of the *Saxifragaceae*, in which he has endeavoured to reduce the conflicting views regarding the limits to be ascribed to the genera to reasonable concepts.

A. The Genera of Hydrangeaceae.

KEY TO THE SUBFAMILIES AND TRIBES OF HYDRANGEACEAE.

Herbs with simple stems from a woody rhizome, or softly woody plants with broad pith; leaves alternate, opposite, or rarely

* Continued from *Kew Bull.* 1925: 168.

† *Kew Bull.*, 1924: 114.

‡ The Families of Flowering Plants. I. Dicotyledons (1926).

verticillate; flowers in cymes or flattish corymbs, rarely in panicles of cymes, showing a strong tendency towards the abortion and enlargement of the outermost flowers with petaloid calyx; placentas parietal to axile.....

Subfamily I. HYDRANGEOIDEAE.

Tribe 1. **Kirengeshomeae**. Herbs with simple stems arising from a creeping rhizome; petals contorted or imbricate; stamens numerous, 15 or more; ovary semi-inferior to quite inferior.

Tribe 2. **Hydrangeae**. Softly woody plants with branched stems, or rarely climbers; petals valvate; ovary inferior.

Shrubs or small trees mostly with fairly tough wood, or rarely (by reduction) decumbent shrubs; leaves opposite or verticillate; flowers all fertile; calyx not petaloid; placentas axile

Subfamily II. PHILADELPHOIDEAE.

Tribe 3. **Carpenterieae**. Ovary superior or subsuperior; stamens numerous or definite; leaves opposite.

Tribe 4. **Philadelphae**. Ovary inferior or almost so (at least $\frac{3}{4}$ -inferior); stamens numerous or definite; leaves opposite or verticillate.

KEY TO THE GENERA.

SUBFAMILY I. HYDRANGEOIDEAE.

Tribe 1. KIRENGESHOMEAE.

Ovary semi-inferior; petals contorted; stamens 15, in 3 series; flowers few in a terminal lax leafy cyme, none sterile; leaves opposite*.....1. **Kirengeshoma**.

Ovary quite inferior; petals imbricate†; stamens numerous; flowers in spreading corymbose cymes, the outer flowers sterile with enlarged petaloid calyx-lobes:

Leaves alternate, scattered on the stem, not lobed, coarsely serrate; styles 3, rather short; flowers small, numerous.....

2. **Cardiandra**.

Leaves opposite or subverticillate, mostly bilobed; styles connate high up.....3. **Deinanth**.

Tribe 2. HYDRANGEEAE.

Styles 4-5, free or connate only at the base; capsule opening at the top between the styles; sterile flowers with 4-5 enlarged more or less petaloid sepals, or if absent then leaves often gland-dotted and the inflorescence enclosed in bud by large bracts; stamens 8-10 (very rarely 15)4. **Hydrangea**.

* Sometimes reverting to an alternate condition under cultivation.

† Not valvate in *Cardiandra* as stated in Benth. et Hook. f., Gen. Pl.

- Style 1; sterile flowers absent, or if present then with only 1 enlarged ovate sepal; capsule opening at the sides between the ribs:
 Stamens 20-30; leaves deciduous; creeping or climbing shrubs;
 petals 7-10; no sterile flowers present5. **Decumaria**.
 Stamens 8-10; petals 4-5:
 Leaves evergreen; petals cohering into a cap; no sterile flowers present.....6. **Pileostegia**.
 Leaves deciduous; petals valvate; sterile flowers with 1 enlarged ovate white sepal.....7. **Schizophragma**.

SUBFAMILY II. PHILADELPHOIDEAE.

Tribe 3. CARPENTERIEAE.

- Styles 3-5, free to the base or nearly so; anther-connective usually not produced at the apex or only slightly so:
 Sepals and petals 5; filaments not divided at the top:
 Shrubs with opposite serrate leaves whitish-pubescent below; flowers white, in terminal cymose panicles; stamens 10; ovules and seeds numerous; petals imbricate* ...8. **Jamesia**.
 Low shrubs with opposite thinly pubescent leaves; flowers white, very small, in terminal head-like long-pedunculate racemes; stamens 4-12; ovule solitary in each loculus; petals imbricate9. **Whipplea**.
 Low shrubs with small opposite entire leaves; flowers very small, in compact head-like cymes; petals clawed; stamens 10; ovules several in each loculus.....10. **Fendlerella**.
 Sepals and petals 4; filaments divided at the top and produced beyond the anther; styles 4, separate; ovules numerous in each loculus; seeds few; shrubs with opposite entire leaves and few terminal whitish flowers.....11. **Fendlera**.
 Styles united, with 5-7 stigmas; stamens 20 or more; filaments not divided at the apex; anther-connective not produced at the apex; petals contorted; ovules numerous; shrub with quadrangular branches, opposite leaves, and handsome white cymose flowers; indumentum of leaves of two kinds, of long appressed hairs and short strigose hairs.....12. **Carpenteria**.
 Style simple, with undivided stigma; stamens 15, connate at the base; anther-connective produced at the apex; ovules 5-7 in each of the 3 loculi, erect; tree with opposite lanceolate leaves and small cymose flowers13. **Kania**.

Tribe 4. PHILADELPHAEAE.

Fruit a capsule:

- Stamens numerous (20 or more; 15 in only one sp.); capsule obconic or obovoid; styles free or connate at the base:
 Petals imbricate.....14. **Philadelphus**.
 Petals 4, valvate; style 2, slender; prostrate or creeping shrubs.....15. **Platycrater**.

* Not convolute as described in various works.

Stamens 12-15; capsule globose; filaments narrowed from the base to the apex, not toothed; petals imbricate

16. **Neodeutzia**.

Stamens 10; capsule subglobose; styles 3-4, free; filaments often expanded or trifold at the apex; petals imbricate or induplicate valvate17. **Deutzia**.

Fruit a berry:

Styles free, clavate; shrubs with opposite leaves and numerous hermaphrodite flowers in terminal panicles.....18. **Dichroa**.

Styles connate; small trees with opposite or verticillate serrate leaves and terminal corymbs of rather small polygamodioecious flowers19. **Broussaisia**.

Taxonomic References.—DC., Prodr. 4: 13-16 (1830) (under *Saxifragaceae*). Endl., Gen. Pl.: 820-822 (1839) (as suborder of *Saxifragaceae*). Lindl., Veg. Kingd.: 569-570 (1846). Benth. et Hook. f., Gen. Pl. 1: 640-644 (1865). Baill., Hist. Pl. 3: 432-436 (1872) (under *Saxifragacées*). Engl. & Prantl, Nat. Pflanzenf. 3, 2A: 69-77 (1890) (under *Saxifragaceae*). C. K. Schneider, Ill. Handb. Laubholz. 1: 360-395 (1904) (under *Saxifragaceae*). Small & Rydb. in N. Amer. Fl. 22: 159-178 (1905).

Characters occurring in relatively few genera or species.—Stems: herbaceous and simple from an underground rhizome in Tribe *Kirengeshomeae*. Leaves: palmately nerved in *Kirengeshoma*; alternate in *Cardiandra* and (under cultivation) in *Kirengeshoma*; subverticillate in *Deinanthæ caerulea* Stapf; deeply bilobed in *Deinanthæ*; evergreen in *Pileostegia*; gland-dotted in some Philippine and S. American spp. of *Hydrangea*. Indumentum: stellate in *Hydrangea* spp., *Neodeutzia*, *Deutzia* spp., *Philadelphus*. Inflorescence: subcapitate in *Whipplea* and *Fendlerella*; covered in bud by large imbricate bracts in certain Philippine and S. American spp. of *Hydrangea*. Flowers: polygamodioecious in *Broussaisia*; outer flowers sterile with petaloid calyx in *Cardiandra*, *Deinanthæ*, and most spp. of *Hydrangea*; one calyx-lobe much enlarged and petaloid in *Schizophragma*. Corolla: petals cohering into a cap in *Pileostegia*; valvate in Tribe *Hydrangeae*, *Platycrater*, *Deutzia* spp., *Dichroa*, and *Broussaisia*. Stamens: numerous (15 or more) in Tribe *Kirengeshomeae*, *Carpenteria*, *Neodeutzia*, *Philadelphus*, *Platycrater*, *Cardiandra*; filaments divided at the apex into two long arms overtopping the anther in *Fendleria*; with two lateral lobes in *Deutzia* spp. Fruit: a capsule opening between the ribs in *Decumaria*, *Pileostegia*, and *Schizophragma*; a berry in *Dichroa* and *Broussaisia*.

NOTES ON PHYLOGENY AND CLASSIFICATION.

The *Hydrangeaceae*, as defined in the present paper, seem to be a group which has arisen from two different sources. For example it appears possible that *Hydrangea*, a softly woody genus, has had

a different phylogenetic history from that of such genera as *Deutzia* and *Philadelphus*. The progenitor of *Hydrangea* was probably a type similar to *Kirengeshoma*, a rare Japanese monotypic genus. In habit this plant resembles some members of the *Ranales* and also the herbaceous *Berberidaceae*, being a herb with a simple stem arising from a creeping rhizome. The ovary is only partly inferior, the styles are free, the stamens are 15 in three series, the flowers are few in lax leafy cymes in which the outer are not sterile, and the petals are contorted. An apparently advanced character is the opposite leaves, but it should be noted that under cultivation they revert to the alternate* condition.

The next genus in order of advancement is *Cardiandra*, again a herb, with alternate leaves scattered on the stem and the flowers more numerous, and, in common with the next genus *Deinathe* (with opposite or subverticillate leaves), it has the outer flowers sterile with enlarged petaloid calyx-lobes.

So there seem to be still preserved three genera which show the path of development from a herbaceous habit right up to the genus *Hydrangea*, familiar to everyone as being softly woody with branched stems, opposite leaves, valvate petals, few stamens, completely inferior ovary, and with nearly always a considerable number of the flowers sterile with petaloid sepals.

Further modifications on different lines have also occurred in this small and interesting group. For instance in the advanced genus *Decumaria* the habit has become creeping or climbing, and the styles have become consolidated into one as in *Pileostegia* and *Schizophragma*. The fruit is remarkable in these three genera in that it opens, not at the top as in *Hydrangea*, but at the sides between the ribs. In *Pileostegia* the petals cohere into a cap, and in *Schizophragma* the sterile flowers have only one enlarged sepal such as we find in the remarkable genus *Mussaenda* in *Rubiaceae*. It is interesting to note that another case of mimicry of *Rubiaceae* (with *Oldenlandia*) is shown by *Vahlia* in the true *Saxifragaceae* (see p. 113).

The second and generally more advanced subfamily *Philadelphoideae* seems to have had quite a separate origin from the *Hydrangeoideae*, and such similarity as exists is revealed mainly by their floral diagrams and is due probably to convergent evolution. In habit they are shrubs or small trees, or very rarely and then clearly by reduction in growth-form, decumbent shrubs. The leaves are always opposite or verticillate, and there is a gradation in the gynaecium from quite superior to completely inferior. The affinity of the most primitive members of this subfamily is clearly with the *Rosaceae*, and perhaps the origin of these two families is to be looked for in the *Dilleniales*, which have free carpels and the same general *facies* as the *Rosaceae*. I have begun the classification of this subfamily with the tribe *Carpenterieae*, with superior or

* This is another interesting case in which the apparently fixed character of the opposite leaves reverts readily to the alternate condition. The same thing occurs in *Clematopsis Stanleyi* Hutch. (See *Kew Bull.* 1920: 21).

subsuperior ovary and sometimes numerous stamens. *Jamesia* is decidedly 'rosaceous' in appearance and affinity; it has free styles and 5 sepals and petals, the latter imbricate. Three other small genera differ but slightly (see key), *Fendlera* being tetramerous. *Carpenteria* is probably just as primitive as *Jamesia*, but it has united styles and it seems to lead up to the tribe *Philadelphaeae*, especially to *Philadelphus*, which appears to be the basal genus for most of the remaining genera, particularly *Deutzia*. Although the gap seems considerable, I do not consider *Carpenteria* to be very far removed from *Crossosoma*, formerly included in the *Dilleniaceae*, and retained by me as an allied separate family. It is noteworthy that both genera are Californian.

The capsular fruit of the above-mentioned genera gives place to a berry in *Dichroa* and *Broussaisia*, the latter with flowers tending to become unisexual. The great resemblance of some of these

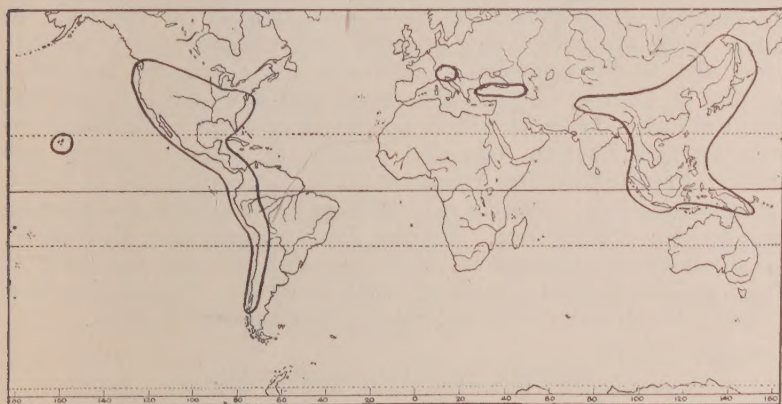


Fig. 1. Range of *Hydrangeaceae*.

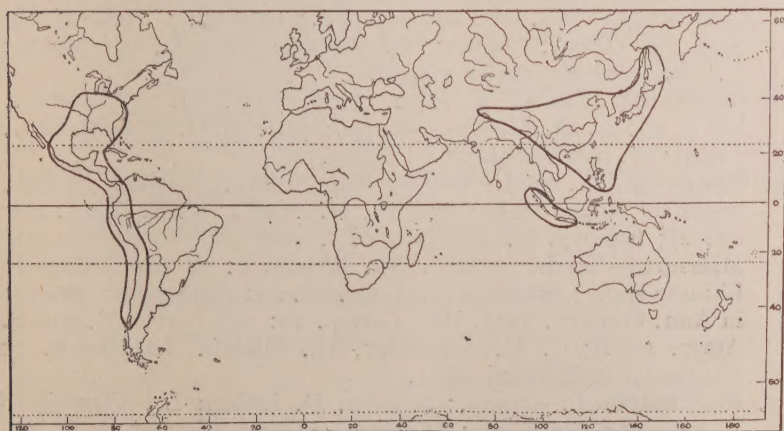


Fig. 2. Range of *Hydrangeae*.

latter genera to *Viburnum* (*Caprifoliaceae*) and to some *Araliaceae* is perhaps more than superficial. Then may not the section *Opulus* of *Viburnum* be a counterpart of *Hydrangea*? Finally the new genus from Mexico recently described by Small as *Neodeutzia* is very interesting in that it supplies a link between *Philadelphus* (with numerous stamens) and *Deutzia* (with definite stamens), although from a phylogenetic standpoint the name is not appropriate, for the plant is an *ancient* and not a *new* type of *Deutzia*.

GEOGRAPHICAL DISTRIBUTION.

The most noteworthy fact about the distribution of *Hydrangeaceae* (see fig. 1) is their entire absence from Africa, Australia, and New Zealand. They are found in considerable abundance in the United States of North America, and in Central and Western China, where *Hydrangea* (see fig. 2), *Deutzia* (China only), and *Philadelphus* are represented by a large number of species. In Japan there are some very peculiar and probably very ancient types, such as *Kirengeshoma*, *Cardiandra*, and *Deinanthé*, the latter two also in Central China. The larger and more recently evolved genera are also the more widely spread, *Hydrangea* extending from India through Eastern Asia and Malaya to America (North and South); *Philadelphus* has a similar range, but occurs also in South Europe and Orient. *Deutzia* extends from South Central and Eastern Asia to the Philippines. Besides *Philadelphus* and *Hydrangea*, one small genus, *Decumaria*, shows the link between the floras of China and the Eastern States of North America. *Kania* is in New Guinea, and *Broussaisia* is endemic to the Sandwich Islands.

GENERA OF HYDRANGEACEAE.

1. **Kirengeshoma** Yatabe in Bot. Mag. Tokyo 5: 1 (1890).—1 sp., *K. palmata* Yatabe, Japan.
2. **Cardiandra** Sieb. & Zucc.—3 spp.; type-sp. *C. alternifolia* Sieb. & Zucc., Japan; *C. sinensis* Hemsl., C. China; *C. formosana* Hayata, Formosa.
3. **Deinanthé** Maxim. in Mem. Acad. Imp. Sc. St. Petersburg., Ser. 7, 10: n. 16, 2 (1867).—2 spp.; type-sp. *D. bifida* Maxim., Japan; *D. caerulea* Stapf, C. China.
4. **Hydrangea** L. (incl. *Cornidia* Ruiz & Pav.).—About 75 spp., India to Japan, Malay Archip., N. Amer., W. S. Amer. (see fig. 2); type-sp. *H. arborescens* L., New York to Florida and Missouri.—Rehder in Sarg., Pl. Wilson. 1: 34 (1911) (key to Chinese spp.); Small in N. Amer. Fl. 22: 159 (1905); Briquet in Ann. Conserv. Jard. Bot. Genev. 20: 393 (1916) (C. and S. Amer. spp.); C. K. Schneider, Ill. Handb. Laubholz. 1: 384 (1904) (cultivated spp.).
5. **Decumaria** L.—2 spp.; type-sp. *D. barbara* L., Virginia to Florida and Louisiana; *D. sinensis* Oliv., W. and C. China.—Small in N. Amer. Fl. 22: 175 (1905).

6. **Pileostegia** Hook. f. & Thoms.—2 spp.; type-sp. *P. viburnoides* Hook. f. & Thoms., E. Himal. to S. C. China; *P. urceolata* Hayata, Formosa.
7. **Schizophragma** Sieb. & Zucc.—4 spp., China and Japan; type-sp. *S. hydrangeoides* Sieb. & Zucc., Japan; *S. hypoglaucum* Rehd., Szechuan; *S. integrifolium* Hemsl., Szechuan and Hupeh; *S. Fauriei* Hayata, Formosa.
8. **Jamesia** Torr. & Gray* (*Edwinia* Heller).—3 spp., N. Amer.; type-sp. *J. americana* Torr. & Gray, S. C. U. States.—Small in N. Amer. Fl. 22: 175 (1905) (as *Edwinia*).
9. **Whipplea** Torr.—1 sp., *W. modesta* Torr., C. Calif.—Small in N. Amer. Fl. 22: 178 (1905).
10. **Fendlerella** Heller in Bull. Torr. Bot. Club 25: 626 (1898).—1 sp., *F. utahensis* (S. Wats.) Heller, Utah to New Mexico.—Small in N. Amer. Fl. 22: 176 (1905).
11. **Fendlera** Engelm. et Gray.—2 spp.; type-sp. *F. rupicola* Engelm. & Gray, S. U. States and Mexico; *F. Wrightii* (A. Gray) Heller, Texas to New Mexico.—Small in N. Amer. Fl. 22: 177 (1905).
12. **Carpenteria** Torr.—1 sp., *C. californica* Torr., Calif.—Small in N. Amer. Fl. 22: 177 (1905).
13. **Kania** Schltr. in Engl., Bot. Jahrb. 52: 118, fig. 1 (1914).—1 sp., *K. eugeniioides* Schltr., New Guinea.
14. **Philadelphus** L.—About 70 spp., S. Europe, Asia, N. and C. Amer.; type-sp. *P. coronarius* L., S. Europe.—Koehne in Gartenfl. 1896: 450; C. K. Schneider, Ill. Handb. Laubholz. 1: 362 (1904), and 2: 929 (1912); Rydberg in N. Amer. Fl. 22: 162 (1905).
15. **Platycrater** Sieb. & Zucc.—1 sp., *P. serrata* (Thunb.) Makino, Japan.—Makino in Bot. Mag. Tokyo 26: 387 (1912).
16. **Neodeutzia** Small in N. Amer. Fl. 22: 161 (1905).—2 spp., Mexico; type-sp. *N. mexicana* (Hemsl.) Small.
17. **Deutzia** Thunb.—About 70 spp., S.C. and E. Asia, Philipp.; type-sp. *D. scabra* Thunb., Japan.—Rehder in Sarg., Pl. Wilson. 1: 14 (1911) (key to Chinese spp.); C. K. Schneider in Mitth. Deutsch. Dendrol. Ges. 1904: 172, and Ill. Handb. Laubholz. 1: 376 (1904).
18. **Dichroa** Lour.—5 spp., India, China, Malay Archip., Philipp., New Guinea; type-sp. *D. febrifuga* Lour., Nepal to China. —Schlechter in Engl., Bot. Jahrb. 52: 121 (1914).
19. **Broussaisia** Gaud.—2 spp., Sandwich Is.; type-sp. *B. arguta* Gaud.

B. The Genera of Saxifragaceae. By J. E. DANDY.

KEY TO THE SUBFAMILIES AND TRIBES OF SAXIFRAGACEAE.

Stigmas dorsal to the carpels; stamens not alternating with staminodes (very rarely all staminodial):

* *Jamesia* Torr. & Gray (1840) is tenable under International Rules. *Jamesia* Raf. (1832) is synonymous with *Dalea* L. (*Papilionaceae*).

Ovules numerous or several on each placenta; capsule septicidal

Subfamily I. SAXIFRAGOIDEAE.

Tribe 1. **Saxifrageae**. Placentas parietal, axile, or almost basal; perennial or annual, often scapigerous herbs with alternate or rarely opposite leaves; ovary superior to inferior.

Tribe 2. **Vahliaeae**. Placentas apical, pendulous; annual herbs with opposite leaves; ovary inferior.

Ovules solitary on each of 2 basal placentas; capsule loculicidal

Subfamily II. EREMOSYNOIDEAE.

Stigmas commissural; stamens alternating with as many staminodes:

Placentas parietal; stamens as many as the sepals; capsule loculicidal; flowers 5-merous, solitary.

Subfamily III. PARNASSIOIDEAE.

Placentas axile; stamens twice as many as the sepals; capsule septicidal; flowers normally 4-merous, in racemes.....

Subfamily IV. FRANCOOIDEAE.

KEY TO THE GENERA.

SUBFAMILY I. SAXIFRAGOIDEAE.

Tribe 1. SAXIFRAGEAE.

Inflorescence cymose or racemose, or flowers solitary; leaves simple, 3-foliolate, palmate, or pinnate; flowers usually bisexual; ovary 1-5-locular:

Carpels almost free or united; flowers usually bracteate; leaves simple (rarely 3-foliolate); receptacle flat to tubular; stamens 3-10:

Ovary 1-locular with parietal (rarely almost basal) placentas:

Flowers 5-merous, in racemes or panicles with inconspicuous bracts; petals usually present:

Carpels equal or subequal; placentas usually parietal:

Inflorescence racemose; petals often divided:

Carpels 3 (rarely more or 2 and then receptacle turbinate):

Stamens 10; petals divided or entire

1. **Lithophragma**.

Stamens 5; petals entire.....2. **Conimitella**.

Carpels 2; receptacle patelliform, campanulate, or tubular:

Receptacle patelliform or shallowly campanulate; capsule not or abruptly beaked.....3. **Mitella**.

Receptacle deeply campanulate or tubular; capsule gradually beaked:

Receptacle not split; stamens 5 or 10; sepals equal; petals not filiform:

Stamens 10; petals usually pinnatifid

4. **Tellima**.

- Stamens 5; petals entire or 3-5-cleft.....
5. **Elmera.**
- Receptacle split down the anterior side; stamens 3; sepals unequal; petals filiform...6. **Tolmiea.**
- Inflorescence paniculate, sometimes spiciform; petals entire (sometimes absent); stamens 5...7. **Heuchera.**
- Carpels unequal, especially in fruit; placentas almost basal; stamens 10.....8. **Tiarella.**
- Flowers 4-5-merous, solitary or in small cymes with conspicuous foliaceous bracts; petals absent.....
9. **Chrysosplenium.**
- Ovary 2-5-locular with axile (rarely almost basal) placentas: Carpels free except at the very base; inflorescence cymose; stamens 10; leaves undivided or peltate:
- Anthers 2-locular; petals broad:
- Leaves not peltate, dotted with sunken glands; receptacle free from the carpels; sepals erect.....
10. **Bergenia.**
- Leaves peltate, without sunken glands; receptacle united with the carpels; sepals reflexed at maturity
11. **Peltiphyllum.**
- Anthers 1-locular; petals narrow, small
12. **Leptarrhena.**
- Carpels more or less united:
- Receptacle flat to cupular, completely united with the ovary:
- Stamens 10 (rarely 8):
- Petals sharply differentiated from the receptacle, narrowed at the base (rarely absent):
- Petioles, if present, not articulated at the top.....
13. **Saxifraga.**
- Petioles slender, articulated at the top; leaves flabelliform; sepals and petals reflexed.....
14. **Saxifragopsis.**
- Petals like the sepals not differentiated from the receptacle, broad at the base, shorter and narrower than the sepals; leaves long-petioled, cordate, 3-7-lobed.....15. **Zahlbrucknera.**
- Stamens 5:
- Petals 5, acute, shorter than the sepals; flowers in cymes.....16. **Hieronymusia.**
- Petals absent or 2-3, unequal; flowers solitary, axillary.....17. **Saxifragella.**
- Receptacle cupular or campanulate, free at least above from the ovary:
- Ovary free from the receptacle:
- Stamens 10; petals oblong or ovate, clawed.....
18. **Jepsonia.**

- Stamens 5; petals narrowly linear-lanceolate.....
 19. **Bolandra**.
 Ovary partially united with the receptacle:
 Receptacle united in the lower half with the ovary:
 Seeds wingless; stamens 5 or 10.....
 20. **Boykinia**.
 Seeds winged; stamens 5.....21. **Sullivantia**.
 Receptacle almost completely united with the ovary;
 stamens 5..... 22. **Suksdorfia**.
 Carpels united; flowers ebracteate, small, in a dichotomous
 panicle; leaves simple, palmate, or pinnate, long-petioled;
 receptacle shallow; stamens 6-14:
 Panicle small; leaves simple, not peltate; stamens 6-14:
 Stamens 10-14; petals absent; sepals petaloid
 23. **Oresitrophe**.
 Stamens 6; petals present, shorter than the sepals.....
 24. **Aceriphyllum**.
 Panicle large; leaves palmate, pinnate, or peltate; stamens 10:
 Leaves simple, peltate; petals present.....25. **Astilboides**.
 Leaves palmate or pinnate; petals usually absent
 26. **Rodgersia**.
 Inflorescence a pyramidal panicle composed of spikes or racemes;
 leaves 2-3-ternate (rarely simple, slender-petioled); flowers
 bracteate, very small, often unisexual; receptacle shallow;
 petals small and narrow or absent; ovary 2-3-locular with
 axile placentas:
 Carpels usually almost free; leaves 2-3-ternate (rarely simple,
 cordate); petals present or absent; stamens 5 or 10.....
 27. **Astilbe**.
 Carpels united; leaves simple, not cordate; petals absent;
 stamens 10; flowers unisexual.....28. **Tanakaea**.

Tribe 2. VAHLIEAE.

- Stamens 5; ovary 1-locular; flowers axillary (only genus).....
 29. **Vahlia**.

SUBFAMILY II. EREMOSYNOIDEAE.

- Stamens 5; ovary 2-locular (only genus).....30. **Eremosyne**.

SUBFAMILY III. PARNASSIOIDEAE.

- Petals usually longer than the sepals; basal leaves long-petioled;
 flowers mostly conspicuous and long-peduncled; perennial.....
 31. **Parnassia**.
 Petals shorter than the sepals, sometimes deficient or absent;
 leaves spathulate; flowers inconspicuous, shortly peduncled;
 annual, minute.....32. **Lepuropetalon**.

- Petals equal; leaves lyrate.....33. **Francoa**.
 Petals unequal, the 2 anterior much smaller or absent; leaves
 cordate-orbicular.....34. **Tetilla**.

Taxonomic References.—Juss., Gen. Pl.: 308–309 and 245 (*Parnassia*, under *Capparides*) (1789). DC., Prodr. 4: 17–54 (1830) and 1: 320 (1824) (*Parnassia*, under *Droseraceae*). Endl., Gen. Pl.: 813–817, 812 (*Francoaceae*, under *Crassulaceae*), and 908 (*Parnassieae*, under *Droseraceae*) (1839). Lindl., Veg. Kingd.: 567–568, 406 (*Parnassia*, under *Hypericaceae*), and 451 (*Francoaceae*) (1846). Benth. & Hook. f., Gen. Pl. 1: 629–640 (1865). Baill., Hist. Pl. 3: 424–430 and 431–432 (*Parnassieae* and *Francoeae*) (1872). Engl. in Engl. & Prantl, Nat. Pflanzenf. 3, 2, A: 41–69 (1890).

Selected Literature.—Payer, Traité d'Organogénie: 183 and t. 39, 15–29; 374 and t. 82, 21–39; 381 and t. 82, 1–20 (1857). Baillon, "Observations sur les Saxifragées", Adansonia 5: 282 (1865). Engler, Monogr. Gatt. *Saxifraga* (1872). Eichler, Blüthendiagr. 2: 421 (1875). Drude, "Ueber die Blüthengestaltung und die Verwandtschaftsverhältnisse des Genus *Parnassia*", in Linnaea 39: 239 (1875). Rosendahl, "Die nordamerikanischen *Saxifraginae* und ihre Verwandtschaftsverhältnisse in Beziehung zu ihrer geographischen Verbreitung", in Engl., Bot. Jahrb. 37, Beibl.: 1 and tt. 4–5 (1905). Juel, "Studien über die Entwicklungsgeschichte von *Saxifraga granulata*", in Nov. Act. Reg. Soc. Sci. Upsal., Ser. 4, 1, 9 and tt. 1–4 (1907). Eichinger, "Beitrag zur Kenntniss und systematischen Stellung der Gattung *Parnassia*", in Beih. Bot. Centralbl. 23, 2: 298 (1908). Pace, "*Parnassia* and some allied Genera", in Bot. Gaz. 54: 306 and tt. 14–17 (1912). A. Arber, "On the Structure of the Androecium in *Parnassia* and its bearing on the Affinities of the Genus", in Ann. Bot. 27: 491 (1913). Rosendahl, "A revision of the genus *Mitella* with a discussion of geographical distribution and relationships", in Engl., Bot. Jahrb. 50, Suppl.: 375 and t. 8 (1914). Murbek, "Über die Organisation und verwandtschaftlichen Beziehungen der Gattung *Lepuropetalon*", in Ark. för Bot. 15, 10 (1918). Engler, "*Saxifraga* (Pars generalis)", Pflanzenr. 4, 117 (1919). Gäumann, "Studien über die Entwicklungsgeschichte einiger *Saxifragales*", in Rec. Trav. Bot. Neerl. 16: 285 (1919).

Characters occurring in relatively few genera or species.—Leaves: palmate or pinnate in *Rodgersia*; 2–3-ternate in *Astilbe* (except *A. simplicifolia*); 3-foliolate in *Tiarella trifoliata* and *T. laciniata*; peltate and large in *Peltiphyllum*, *Astilboides*, and *Boykinia tellimoides*; solitary, basal, and developed after the flowering-

axis in *Oresitrophe*; dotted with sunken pluricellular glands in *Bergenia*; petioles articulated at the top in *Saxifragopsis*. Flowers: zygomorphic in *Tolmiea*, *Saxifraga* sect. *Diptera*, *Tetilla*, and *Heuchera* spp. Receptacle: split down the anterior side in *Tolmiea*. Petals: filiform in *Tolmiea*; not differentiated from the receptacle in *Zahlbrucknera*. Stamens: 3 in *Tolmiea*; 5 opposite the petals in *Mitella* spp.; anthers 1-locular in *Leptarrhena*. Carpels: unequal in *Tiarella*; placentas apical and pendulous in *Vahlia*; ovules solitary and basal in each loculus in *Eremosyne*. Capsule: loculicidal in *Eremosyne*, *Parnassia*, and *Lepuropetalon*.

NOTES ON PHYLOGENY AND CLASSIFICATION.

The family *Saxifragaceae* as considered here is an entirely herbaceous group limited to the tribes *Saxifrageae* and *Francoeae* of the *Genera Plantarum*. To these two tribes Bentham and Hooker allocated 21 genera. More recently *Donatia* has been transferred to the *Stylidiaceae**. Of the genera proposed or revived since the publication of the *Genera Plantarum*, 14 appear to be worthy of retention. The number of genera is thus brought up to 34, comprising nearly 600 species.

The genera fall into four well-marked subfamilies, of which one, the typical *Saxifragoideae*, is very much larger than the others. The subfamilies show little close affinity with each other, and each has some claim to family rank; the *Parnassioideae* and *Francooideae* have in fact been separated as families by some authors.

The *Parnassioideae* and *Francooideae* stand isolated from the other subfamilies on account of their commissural stigmas. This unusual character also occurs in the *Papaveraceae*; these and the *Saxifragaceae* may have had immediate and parallel descent from the *Ranales*†. *Lepuropetalon*, placed in the *Saxifrageae* by Engler, is better associated with *Parnassia* in the *Parnassioideae* on account of its commissural stigmas, whorl of staminodes, and loculicidal capsule‡. Besides the position of the stigmas, the *Parnassioideae* and *Francooideae* resemble each other and differ from the remaining subfamilies in the possession of a whorl of staminodes, but otherwise they have little in common. These two subfamilies are on the whole better retained within the *Saxifragaceae*, though it has been stated that *Parnassia* has affinities with the *Droseraceae* and *Hypericaceae*§.

Eremosyne, the single and monotypic genus of *Eremosynioideae*, is exceptional in the family, not only on account of its solitary ovules, but also in its geographical range (S.W. Australia); it differs from the *Saxifragoideae* also in having a loculicidal capsule. In spite of these differences, however, the genus is conveniently retained within the *Saxifragaceae*.

* F. von Mueller, *Fragm. Phytogr. Austral.* 8: 41 (1873); Mildbraed in *Engl., Pflanzenr.* 4, 278: 15 (1908).

† Hutchinson, *Fam. Flowering Pl.* 1: 8, diag. (1926).

‡ Murbeck in *Ark. för Bot.* 15, 10: 12 (1918).

§ See Selected Literature (p. 111).

In the *Saxifragoideae*, *Vahlia* is quite distinct in its type of placentation, "rubiaceous" habit with opposite leaves (showing a remarkable resemblance to *Oldenlandia*), and tropical distribution; it seems worthy of tribal rank. The remaining genera form a very natural group, amongst which *Tanakaea* is closely related to *Astilbe* through *A. simplicifolia*, while *Oresitrophe*, *Aceriphyllum*, *Astilboides*, and *Rodgersia* are allied in their habit and type of inflorescence and flower. The large and successful genus *Chrysosplenium*, with its distinct habit and apetalous flowers, has advanced into an isolated position somewhat remote from the other genera. The antiquity of the subfamily is evident from the occurrence of almost free carpels in several genera. The androecium is limited to one or two whorls of stamens, but in other floral organs the subfamily shows progressive stages in the fulfilment of several evolutionary tendencies, e.g. union of carpels, hollowing of the receptacle and its union with the ovary, and development of axile from parietal placentation. In certain genera special developments have taken place, such as the zygomorphic flower with reduced number of stamens in *Tolmiea*, and the compound inflorescence with tendencies towards unisexuality and apetaly active in *Astilbe* and fulfilled in *Tanakaea*. It is possible that in some genera, e.g. *Tanakaea*, a bilocular ovary with axile placentas has arisen by direct union of the carpels by their ventral faces. In others a bilocular ovary has been formed by the intrusion and meeting of the parietal placentas of an unilocular ovary. This is undoubtedly the case in the *Rodgersia* group, where the placentas often separate again in fruit. In *Aceriphyllum* the ovary is not completely bilocular, for the placentas meet only in the upper part of the ovary*.

It is probable that the *Saxifragoideae* found a direct origin in a Ranalean Stock, for like the *Ranunculaceae* they have seeds with copious endosperm and minute embryo. In this point they differ from the *Rosaceae*, their supposed affinity with which on account of a general evolutionary tendency (i.e. *perigyny*), has possibly been unduly emphasised. The resemblances between the *Saxifragoideae* and *Rosaceae* are probably due to parallel development. In one case, i.e. *Astilbe* ("Spiraea" of some authors) and *Aruncus* (*Rosaceae*), the similarity in habit is so very striking that it has led to considerable confusion between the two genera, especially in gardens.

GEOGRAPHICAL DISTRIBUTION.

The *Saxifragaceae* are predominantly plants of the North Temperate and Arctic regions, where the frequently discontinuous type of distribution of the genera emphasises the antiquity of the group but at the same time renders difficult the tracing by its aid of the paths of evolution within the family. The only truly tropical genus is *Vahlia*; other genera occur within the tropical zone, but

* Engler in his original description of the genus states that the ovary is as in *Saxifraga*, to which genus Oliver referred the plant in the first place.

only on the mountains. Except for an isolated monotypic genus in South Western Australia and one species of *Astilbe* in Western New Guinea, *Saxifragaceae* are absent from Australasia and Polynesia.



Fig. 3. Range of *Saxifraga* and allied genera.—1, *Saxifraga*; 2, *Saxifragopsis*; 3, *Zahlbrucknera*; 4, *Hieronymusia*; 5, *Saxifragella*.



Fig. 4. 1, Range of *Chrysosplenium*; 2, *Vahlia*; 3, *Eremosyne*.

Saxifragoideae.—With the exception of *Vahlia*, the plants of this large subfamily are characteristic of the Arctic and Alpine floras of the Northern Hemisphere, while a few species inhabit the

Andes, Java, and Western New Guinea. *Saxifraga* (see fig. 3) and *Chrysosplenium* (see fig. 4) are circumboreal, and both have representatives in the Andes; one species of *Saxifraga* occurs in N. Siam, while another is confined to the mountains of Abyssinia. Twelve genera are exclusively North American, and of these ten are peculiar to the Rocky Mountains region. Central and Eastern Asia has six genera, of which three are confined to the Manchurian and Korean region, while one is endemic to Japan. *Zahlbrucknera* is restricted to the mountains of Austria, and *Hieronymusia* and *Saxifragella* to the Andes (see fig. 3). The floras of North America and Eastern Asia are connected by *Mitella*, *Tiarella*, *Leptarrhena*, *Boykinia*, and *Astilbe* (see fig. 5). *Astilbe* also has species in the Philippines, Java, and Western New Guinea. *Vahlia* has a tropical and sub-tropical distribution throughout the Old World (fig. 4); it is a recent type, whose species, being annuals, have probably spread rapidly over the region. Eastern Asia and the Rocky Mountains have been the chief centres of evolution of the genera.

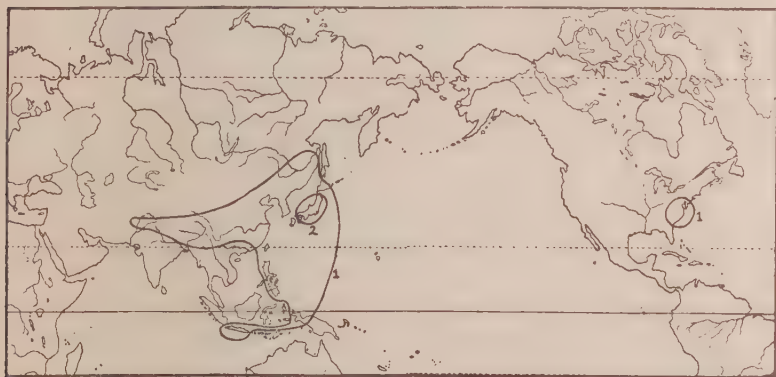


Fig. 5. 1, Range of *Astilbe*; 2, *Tanakaea*.

Eremosynoideae.—The solitary genus *Eremosyne* is confined to South Western Australia, and is thus isolated geographically from the rest of the family (see fig. 4). Its distribution is almost identical with that of the monotypic *Cephalotaceae* (*Cephalotus*).

Parnassioideae.—The range of this subfamily bears a general resemblance to those of *Saxifraga* and *Chrysosplenium* in the *Saxifragoideae*. *Parnassia*, unlike those two genera, is absent from the Andes (see fig. 6); *Lepuropetalon*, however, has been recorded from Chile and also from Uruguay. This genus has a remarkable distribution, being found in three relatively small areas, two of them in South America, the other in South Eastern North America (see fig. 6).

Francooideae.—The two genera of this subfamily are endemic to Chile, where *Francoa*, the more primitive in floral characters, has a wider range than *Tetilla*.

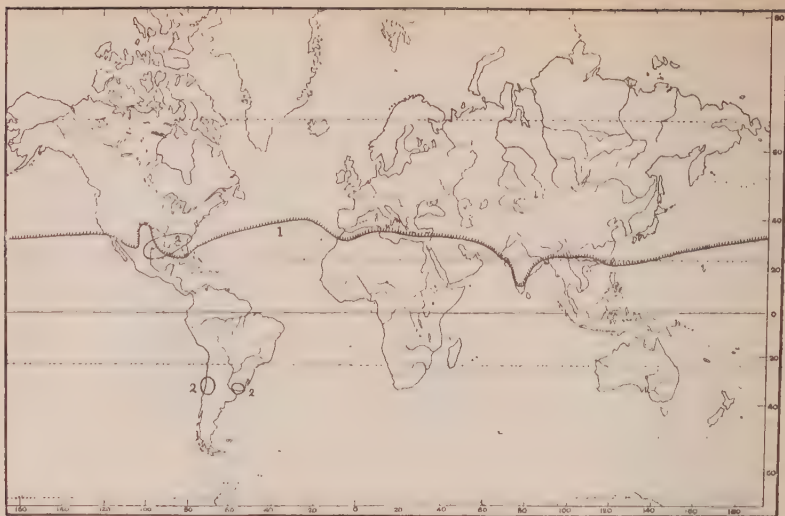


Fig. 6. Range of Parnassioideae.—1, *Parnassia*; 2, *Lepuropetalon*.

GENERA OF SAXIFRAGACEAE.

1. **Lithophragma** Nutt. in Journ. Acad. Philad. 7: 26 (1834) (under *Tellima* in Gen. Pl.).—9 spp., W.N. Amer. from Brit. Columbia and Alberta to Calif., Arizona, and New Mexico; type-sp. *L. parviflorum* (Hook.) Nutt., Brit. Columbia to Colorado.—Rosendahl in Engl., Bot. Jahrb. 37, Beibl.: 85 (1905); Rydberg in N. Amer. Fl. 22: 84 (1905) recognises 20 spp.
2. **Conimitella** Rydb. in N. Amer. Fl. 22: 96 (1905).—1 sp., *C. Williamsii* (D.C.Eaton) Rydb., Montana, Idaho, and Wyoming.
3. **Mitella** L. (incl. *Mitellastra* Howell, *Ozomelis* Raf., *Pectiantia* Raf.).—13 spp., N. Amer., N.E. Asia, Japan, and Formosa; type-sp. *M. diphylla* L., E.N. Amer.; *M. nuda* L., N.E. Asia and N. Amer.; *M. japonica* Miq., Japan and Formosa.—Revision by Rosendahl in Engl., Bot. Jahrb. 50, Suppl.: 375 (1914).
4. **Tellima** R. Br.—1 sp., *T. grandiflora* (Pursh) Dougl., Pacif. N. Amer. from S. Alaska to N. Calif.—Rydberg in N. Amer. Fl. 22: 90 (1905) recognises 3 spp.
5. **Elmera** Rydb. in N. Amer. Fl. 22: 97 (1905).—1 sp., *E. racemosa* (S. Wats.) Rydb., Washington.
6. **Tolmiea** Torr. & Gray (*Leptaxis* Raf.).—1 sp., *T. Menziesii* (Pursh) Torr. & Gray, Pacif. N. Amer. from Brit. Columbia to N. Calif.
7. **Heuchera** L.—About 30 spp., Temp. N. Amer. and southwards into S. Mexico; type-sp. *H. americana* L., E.N. Amer.—Rosendahl in Engl., Bot. Jahrb. 37, Beibl.: 76 (1905); Rydberg in N. Amer. Fl. 22: 97 (1905) multiplies the spp. to 72.

8. **Tiareella** L.—5 spp.; *T. polyphylla* D. Don in E. Himal., China, and Japan, others in Pacif. and E.N. Amer.; type-sp. *T. cordifolia* L., E.N. Amer.—*T. trifoliata* L. and *T. laciniata* Hook. have 3-foliolate leaves.
9. **Chrysosplenium** L.—About 85 spp., all Arctic and N. Temp. except *C. valdivicum* Hook. and *C. macranthum* Hook. in Temp. S. Amer.; type-sp. *C. oppositifolium* L., Europe.—Monogr. by Franchet in Nouv. Arch. Mus. Hist. Nat., Ser. 3, 2: 87 (1890), and 3: 1 (1891).
10. **Bergenia** Moench, Meth.: 664 (1794) (under *Saxifraga* in Gen. Pl.).—8 spp., C. and E. Asia, excl. Japan; type-sp. *B. crassifolia* (L.) Fritsch, C. Asia; *B. pacifica* Komarov, Maritime Prov.; *B. coreana* Nakai, Korea.
11. **Peltiphyllum** Engl. in Engl. & Prantl, Nat. Pflanzenf. 3, 2, A: 61 (1890).—1 sp., *P. pellatum* (Torr.) Engl., Oregon to C. Calif.
12. **Leptarrhena** R. Br.—1 sp., *L. pyrolifolia* (D. Don.) R. Br., Kamschatka and Pacif. N. Amer. from Alaska to Washington.
13. **Saxifraga** L.—About 320 spp., all Arctic and N. Temp. except *S. hederifolia* Hochst. in Abyssinia and 4 spp. in Andes, 1 sp. extending southwards into N. Siam; type-sp. *S. granulata* L., Europe and Morocco.—*S. nana* Engl. has 4-merous apetalous flowers and opposite leaves; sect. *Diplera* has unequal petals.—Monogr. by Engler and Irmscher in Engl., Pflanzenf. 4, 117 (1916 and 1919).
14. **Saxifragopsis** Small in Bull. Torr. Bot. Club 23: 19 (1896).—1 sp., *S. fragarioides* (Greene) Small, S. Oregon and N. Calif.
15. **Zahlbrucknera** Reichenb.—1 sp., *Z. paradoxa* (Sternb.) Reichenb., Austria.
16. **Hieronymusia** Engl. in Notizbl. Bot. Gart. Berl. 7: 265 (1918).—1 sp., *H. alchemilloides* (Griseb.) Engl., Andes of S. Bolivia and N. Argentine.
17. **Saxifragella** Engl. in Engl. & Prantl, Nat. Pflanzenf. 3, 2, A: 61 (1890).—2 spp., Tierra del Fuego region; type-sp. *S. bicuspidata* (Hook. f.) Engl.; *S. Albowiana* (Kurtz) Engl.
18. **Jepsonia** Small in Bull. Torr. Bot. Club 23: 18 (1896).—3 spp., Calif.; type-sp. *J. Parryi* (Torr.) Small, C. and S. Calif.; *J. malvifolia* (Greene) Small, S. Rosa and S. Cruz Is.; *J. neomuttalliana* Millsp., S. Catalina I.—Rosendahl in Engl., Bot. Jahrb. 37, Beibl.: 60 (1905); Small in N. Amer. Fl. 22: 120 (1905).
19. **Bolandra** A. Gray in Proc. Amer. Acad. 7: 341 (1868).—2 spp., Pacif. U. States; type-sp. *B. californica* A. Gray, Calif.; *B. oregana* S. Wats., Washington and Oregon.—Rosendahl in Engl., Bot. Jahrb. 37, Beibl.: 59 (1905); Rydberg in N. Amer. Fl. 22: 119 (1905).
20. **Boykinia** Nutt. (incl. *Therophon* Raf., *Telesonix* Raf.).—9 spp.; *B. lycoctonifolia* (Maxim.) Engl. and *B. tellimoides*

- (Maxim.) Engl. in Japan, others in N. Amer.; type-sp. *B. aconitifolia* Nutt., E. U. States; *B. Richardsonii* (Hook.) A. Gray, Arctic N. Amer.—*B. tellimoides* has peltate leaves.
21. **Sullivantia** Torr. & Gray.—2 spp., U. States; type-sp. *S. Sullivantii* (Torr. & Gray) Britton, Minnesota to Ohio; *S. oregana* S. Wats., Oregon, and Montana to Colorado.—Rosen-dahl in Engl., Bot. Jahrb. 37, Beibl.: 60 (1905); Small in N. Amer. Fl. 22: 121 (1905) recognises 4 spp.
 22. **Suksdorfia** A. Gray in Proc. Amer. Acad. 15: 41 (1880) (incl. *Hemivia* Raf.).—2 spp., W.N. Amer. from S. Brit. Columbia and Alberta to Oregon and Montana; type-sp. *S. violacea* A. Gray; *S. ranunculifolia* (Hook.) Engl.—Rosen-dahl in Engl., Bot. Jahrb. 37, Beibl.: 60 (1905).
 23. **Oresitrophe** Bunge.—1 sp., *O. rupifraga* Bunge, N. China (Chihli).
 24. **Aceriphyllum** Engl. in Engl. & Prantl, Nat. Pflanzenf. 3, 2, A:52 (1890).—1 sp., *A. Rossii* (Oliv.) Engl., S. Manchuria and Korea.
 25. **Astilboides** Engl., Pflanzenr. 4, 117:675 (1919) (nomen).—1 sp., *A. tabularis* (Hemsl.) Engl., S. Manchuria and Korea.
 26. **Rodgersia** A. Gray.—5 spp., E. Asia; type-sp. *R. podophylla* A. Gray, Korea and Japan; others in China.
 27. **Astilbe** Buch.-Ham.—About 24 spp.; *A. bitemata* (Vent.) Britton, E. U. States; *A. speciosa* Jungh., Java; *A. papuana* Schltr., W. New Guinea; 2 spp. in Philipp.; others Himal. and E. Asia; type-sp. *A. rivularis* Buch.-Ham., Himal. to W. China and N. Siam.—*A. simplicifolia* Makino (Japan) has simple leaves.
 28. **Tanakaea** Franch. & Sav., Enum. Pl. Jap. 2: 352 (1879).—1 sp., *T. radicans* Franch. & Sav., Japan.
 29. **Vahlia** Thunb.—7 spp.; *V. viscosa* Roxb. and *V. oldenlandioides* Roxb. in Trop. and Subtrop. Asia and Africa, others in Africa; type-sp. *V. capensis* Thunb., S. Africa.
 30. **Eremosyne** Endl.—1 sp., *E. pectinata* Endl., S.W. Australia.
 31. **Parnassia** L.—About 47 spp., Arctic and N. Temp., extending southwards into India; type-sp. *P. palustris* L., widely distributed.—Drude in Linnaea 39: 239 (1875).
 32. **Lepuropetalon** Elliott (*Pyxidanthera* Muhl.).—1 sp., *L. spathulatum* (Muhl.) Elliott, S.E. N. Amer., C. Chile, and Uruguay.
 33. **Francoa** Cav.—3 spp., Chile; type-sp. *F. appendiculata* Cav.
 34. **Tetilla** DC.—1 sp., *T. hydrocotylifolia* DC., C. Chile.

Excluded Genera.

ARUNCUS Adans. (*Rosaceae-Spiraeaceae*).
 DONATIA Forst. (*Stylidiaceae-Donatioideae*).
 FAURIA Franch. (*Gentianaceae-Menyantheae*).
 KIRENGESHOMA Yatabe (*Hydrangeaceae-Kirengeshomeae*).
 LUETKEA Bong. = *Eriogynia* Hook. (*Rosaceae-Spiraeaceae*).

XV.—NEW SPECIES FROM PANAMA, COIBA AND COCOS ISLANDS. L. A. M. RILEY.

("St. George" Pacific Expedition, 1924-25*)

The following eleven new species form part of the collection of plants made in 1924 by the writer in Panama, and by other members of the Expedition in the islands of Taboga and Coiba, in the Pearl Islands, and in Cocos Island.

With the exception of a few common species collected in the neighbourhood of Colon, the whole of the Panama collection was made within ten miles of the city of Panama. It is somewhat notable that so many new species (eight) should have been obtained in what is now a well-worked area botanically. The islands of Coiba and Cocos are less known.

Of the complete collection the first set has been presented to Kew, and the second set to the British Museum.

Odontocarya nitida Riley, sp. nov. [Menispermaceae-Tinosporaceae]; affinis *O. tamoidi* Miers, sed foliis pro rata angustioribus sinu basali multo minori et angustiori, petiolis et inflorescentiis pilosis haud glabris differt.

Caules volubiles, graciles, leviter striati, glabri vel sparse pilosi; novelli 0.5-2 cm. longi, sub folio infimo 1.25-1.5 mm. diametro, dense pubescentes. *Folia* suboblique cordato-ovata, 4-12 cm. longa, 3.5-6 cm. lata, obtuse acuminata vel obtusa, integra, palmatim 5-nervia, nervis inferioribus brevibus patentibus, superioribus acute ascendentibus, supra sparse et brevissime pilosa, primo visu glabra, subtus glabra, costa et nervis maioribus et interdum venulis molliter et sparse pilosis, utrinque laete viridia, nitida, nervis et rete venularum iucunde conspicuis; petioli 2-5 cm. longi, breviter pilosi. *Racemi* ♂ axillares, ob breviter novellorum subcongesti, basi breviter ramosi, 3-6 cm. longi, satis dense pilosi. *Bracteae* lineares, circiter 1 mm. longae; bracteolae 0.5 mm. longae. *Tepala* 24, 8-seriata, ovata, acuta vel subacuta, pubescentia, plerumque 1.5-1.75 mm. longa, 1-1.5 mm. lata, extimis et intimis minoribus 1 mm. longis 0.75 mm. latis. *Stamina* 6, vix basi connata, 0.75 mm. longa, filamentis e basi in antheras subtetrathecas 0.25 mm. latas gradatim dilatatis. *Inflorescentia* ♀ haud visa.

PANAMA: Cocoli, fl. June, Riley 136 (type in Herb. Kew.).

Elsota chrysotricha Riley, sp. nov. [Polygalaceae]; affinis *E. molli* (H.B.K.) Kuntze, alis extra fulvo-sericeis haud glabris, fructu haud vel vix cristato differt.

Caules scandentes, 3-4 m. attingentes. *Ramuli* teretes, flexuosi, fulvi, pilis pallidioribus crispulis obtecti. *Folia* ovata vel oblongo-ovata, 3.5-8 cm. longa, 2-4 cm. lata, basi plerumque rotundata nonnunquam obtusa vel truncata rarissime subemarginata, apice

* See *Kew Bull.* 1925, 26-33, 133-142, 216-231; 1926, 51-56.

cuneatim vel simpliciter obtuso rarissime emarginato ob fasciculum pilorum e costa productum obtuse quasi-mucronulato, marginibus subrevolutis brevissime ciliatis, supra nitidula, breviter pilosa, reticulata, costa impressa, nervis lateralibus utrinsecus 10-13 elevatis, subtus pubescentia, costa fulva pilis pallidioribus oblecta cum nervis lateralibus elevata; petioli 1.5-2 mm. longi, incrassati, glandulis binis centro cavatis infra articulum in ramulo dispositis. *Racemi* terminales, simplices, 5-8 cm. longi; bracteae lanceolatae, acutae, vix 2 mm. longae, mox deciduae; pedicelli 7-9 mm. longi, ut bracteae sepala et alae extra fulvo-pilosi. *Sepala exteriora* late ovata, 4 mm. longa, 3.5 mm. lata, obtusissima; alae, ungue 3 mm. longo excluso, 9 mm. longae, 8.5 mm. latae, apice rotundato emarginato, basi margine postico rotundata margine antico truncata. *Carina* cucullata, 1.1 cm. longa, ungue 2 mm. longo incluso, minute cristata, ciliata; petala superiora obovata, 1 cm. longa, 7 mm. lata, in basim attenuata, rotundata, vix emarginata. *Vagina staminea* ad fissuram ciliata, extra glabra, intus pilosa. *Ovarium* ovatum, 1.75 mm. altum, 1 mm. latum, hirsutum; stylus glaber, 1.1 cm. longus. *Fructus immaturus* stipitatus, ala margine dorsuali curvato ventrali recta, dense fulvo-pilosa. *Fructus maturus* (e specimine Seemannii descriptus) ovoideus, 8-9 mm. altus, 6-8 mm. diametro, valde rugosus, fulvo-pilosus, ala circiter 4 cm. longa leviter pilosa, margine dorsuali apice curvato ventrali subrecto. *E. coriacea* Blake in N. Am. Fl. xxv. 374, partim. *Securidaca tomentosa* Seemann, Bot. Herald, 81; Hemsl. Biol. Centr.-Am., Bot. i. 63; non St. Hilaire.

PANAMA: in secondary growth at sea level near Old Panama, fl. June, Riley 148 (type in Herb. Kew.); near the city of Panama, fr. Nov. Seemann; in open shrubby places about Panama, fl. June, Sutton Hayes 722. TRINIDAD: Fort St. George's Hill, fl. June, Johnston 112.

Characterized especially by the golden hairs on the outside of the alae. Seemann's and Johnston's specimens have shorter and denser racemes than in the case of the type.

I have compared the above specimens with the description of *Securidaca mollis* in H.B.K. Nov. Gen. v. 421, and I have concluded that they cannot be referred to that species on account of the sericeous alae and the almost complete absence of any crest on the fruit. I have not seen the type-specimen of *S. mollis*, which was collected in Peru on the Upper Amazon. Provisionally I have accepted as typical a specimen collected by Matthews at Chachapoyas in the same district, and which agrees with the description except that the leaves are proportionately somewhat narrower.

The species *Securidaca mollis* described in H.B.K. l.c. was originally published as *S. coriacea* Bonpl. in Ges. Nat. Freunde Berlin Mag. ii. 47 (1808). The name was changed to *S. mollis* with the description in Nov. Gen. et. Sp. v. 421 (1823). [See also Kunth, Syn. Pl. Æq. iii. 323 (1824).] The description of *S. coriacea* is simply "caule scandente, foliis oblongo-ovatis, subtus mollis-

sime tomentosus." This, while sufficient to render valid the combination *Securidaca coriacea*, is hardly adequate as a working description. That of *S. mollis* is long and complete, and presumably drawn up from the same material.

Erythrochiton incomparabilis Riley, sp. nov. [Rutaceae-Cusparieae]; nullae speciei generis adhuc descriptae notabiliter affinis, foliis oppositis breviter petiolatis, inflorescentiis vix vel brevissime pedunculatis bifloris tantum, lobis corollae longe et anguste unguiculatis cognoscetur.

Frutex debilis, 2.4 m. altus. *Ramuli* robusti, 3.5 mm. diametro 15 cm. infra apicem, flexuosi, sulcati, cicatricosi, cinerei, iuventute appresso-pilosi, mox glabrescentes. *Folia* opposita, obovata vel elliptica, 5-20 cm. longa, 2.5-7.5 cm. lata, acuminata acumine obtuso, vel obtusa, interdum rotundata et emarginata, basi in petiolum acute angustata, integra vel leviter undulata, subcoriacea, utrinque obscura, glabra, pellucide punctata, costa valida cum nervis lateralibus utrinque elevata glabra sed in foliis iunioribus versus basin subpilosa, nervis lateralibus utrinsecus circiter 9-11 utrinque conspicuis subpatenter arcuatis anastomosantibus, rete venularum satis manifesta; petioli 4-7 mm. longi, incrassati, rugulosi, subpilosi. *Inflorescentiae* terminales, biflorae; pedunculus subnullus vel usque ad 5 mm. longus; bracteae subulatae, acutae, 3.5-4 mm. longae, pilosae, bracteolis oppositis forma et indumento ut bracteis vix 3 mm. longis pilis longioribus fulvis in axillis fasciculatis; pedicelli 7-9 mm. longi, pubescentes cum pilis longioribus paucis intertextis. *Alabastra* longe ovata, 1.8 cm. longa, 0.7 cm. diametro, apiculata. *Calyx* ad 1.9 cm. longa, basi subtumida, extra sparse pilosa, punctata, inaequaliter 5-lobata, lobis triangulatis acute acuminatis 6-9 mm. longis basi 3-3.5 mm. latis. *Petala* rosea, recurva, longe unguiculata, in tubum coalita, lamina ovata 3 cm. longa 1.4 cm. lata obtusa sparse pilosa in unguem circiter 0.8 cm. longum angustata, tubo 2.5 mm. longo intus pubescenti 5 mm. a basi barbato-annulato. *Staminodia* 5, summo tubo inserta, filiformia, interdum in lamina minuta membranacea complanata, 0.8-1 cm. longa. *Discus* annulatus, 2.5 mm. altus, 5-laciniatus, glaber. *Carpella* 4, fere libera, uniovulata, oblique conica, 1.5 mm. alta, 1 mm. diametro, angulata, rugulosa, nigra; stylus admirabiliter gracilis, filiformis, 3.8 cm. longus, patenter pilosus; stigma capitatum. *Fructus* haud visus.

PANAMA: Coiba island, in thick jungle, fl. Sept., *Collenette* in Riley 470 (type in Herb. Kew.).

A very distinct species with no obvious affinity with any of those previously described. The opposite leaves, much abbreviated inflorescences, long-clawed petals, and the one-ovuled carpels are particularly noteworthy.

Eugenia antiquae Riley, sp. nov. [Myrtaceae-Myrteae]; affinis *E. guayaquilensi* (H.B.K.) DC., ramulis glabris haud hirtellis,

foliis oblanceolatis nec oblongis utrinque glabris, inflorescentiis petiolos superantibus laxioribus floribus maioribus differt.

Arbuscula 9 m. alta. *Ramuli* robusti, 2 mm. diametro 15 cm. infra apicem, teretes, vel iuniores subcompressi, nodis tumidis, ascendentes, glabri, cinerei, iuniores subfusci. *Folia* plerumque oblanceolata, interdum obovata vel elliptica, 5-8.5 cm. longa, 2-4 cm. lata, cuspidato-acuminata, acuta vel subobtusata, basi cuneatim acuta, glabra, obscura, concoloria, costa supra impressa subtus elevata, nervis lateralibus utrinsecus 12-14 ascendentibus elevatis; petioli 4.5-6 mm. longi, verrucosi. *Inflorescentiae* axillares, oppositae, 4-13-florae, rhachi primaria brevissima vix 0.5 mm. longa, secundariis 0.1-1.2 cm. longis plerumque circiter 0.5-0.6 cm. longis, pedicellis 4-7 mm. longis puberulis; bracteae ovatae, obtusae, 0.25 mm. longae; bracteolae proxime infra ovarium geminae, saepe connatae, late ovatae, 0.25 mm. longae, rotundatae. *Lobi calycis* 4, ovati, fere 0.75 mm. alti, fere 1 mm. lati, obtusi vel rotundati, eciliati vel sparsissime ciliati, extra subpuberuli. *Petala* 4, ovata, 3.5 mm. longa, 2.5 mm. lata, obtusa. *Stamina* 20-25; filamenta 5.5-6 mm. longa; antherae subglobosae, circiter 0.25 mm. diametro. *Ovarium* globosum, vix 1 mm. diametro, minute puberulum; stylus valde arcuatus, circiter 6 mm. longus, apice truncatus. *Fructus* haud visus. *E. guayaquilensis* Seemann Bot. Herald, 125; Benth. Bot. Sulph. 98; nec DC.

PANAMA: Old Panama, fl. June, Riley 142 (type in Herb. Kew); Sabanas, Riley 110; Santiago de Veraguas, fl. March, Seemann; near the city of Panama, Seemann 280.

Undoubtedly closely related to *E. guayaquilensis* (H.B.K.) DC., but the more elongated and larger-flowered inflorescences and the absence of indumentum, even from the youngest leaves almost, serve well as distinctive characters. I have not seen the type of *E. guayaquilensis*, but material in the Kew Herbarium collected at Guayaquil by Jameson and Hartweg agrees with the description of that species in H.B.K. Nov. Gen. vi. 147 (*Myrtus guayaquilensis*).

***Alibertia longistipulata* Riley, sp. nov.** [Rubiaceae-Gardenieae]; affinis *A. eduli* A. Rich., a qua foliis maioribus nervis lateralibus pro rata paucioribus, stipulis multo longioribus caudato-acuminatis, tubo corollae femineae longiori cum pubescentia breviori et lobis corollae caudato-acuminatis haud ovato-acutis differt.

Arbuscula ad 4.5 m. alta. *Ramuli* teretes, glabri, fusci vel cinereo-fusci, 2.5-3 mm. diametro 15 cm. infra apices. *Folia* elliptica vel oblongo-elliptica, 10-20 cm. longa, 2.5-7 cm. lata, integra, valde acuminata acumine saepe curvato, basi in petiolum cuneatim angustata, membranacea vel subcoriacea, utrinque glabra, supra nitidula, subtus pallidiora et obscura, costa supra versus apicem elevata versus basin plana vel impressa subtus omnino elevata, nervis lateralibus utrinsecus 9-15 saepe subpatentibus sed versus marginem quem haud attingunt valde arcuatis

anastomosantibus utrinque elevatis; petioli 0.3–1 cm. longi. *Stipulae* anguste triangulares, in acumen caudatum attenuatae, 0.9–1.8 cm. longae, basi 2–3 mm. latae. *Flores masculi* desunt. *Flores feminei* solitarii, sessiles, ad summos ramulos inter folia paris terminalis dispositi. *Calyx* cupulatus vel subcampanulatus, 4.5 mm. altus, 6 mm. diametro, 6-dentatus, extra puberulus, intus glaber, ciliatus. *Corolla* alba, extra breviter pubescens, intus lobis et fauce supra medium tantum pubescentibus, tubo 1.1 cm. longo basi 4 mm. apice 5.5 mm. diametro, lobis 5 ovato-lanceolatis 1.8 cm. longis 0.6 cm. latis caudato-acuminatis. *Stamina abortiva* 5; filamenta 0.75 mm. longa; antherae 5.5 mm. longae, 0.75 mm. latae, apice apiculatae, basi obtusae. *Ovarium* obovoideum, 5.5 mm. altum, 4.5 mm. diametro, puberulum; stylus glaber, usque ad ramos 8 mm. longus, ramis quatuor 6.6 mm. longis acutis. *Fructus* haud visus.

PANAMA: Old Panama, fl. June, Riley 145 (type in Herb. Kew.). ***Alibertia panamensis*** Riley, sp. nov. [Rubiaceae—Gardenieae]; affinis *A. eduli* A. Rich., a qua foliis vix coriaceis obscurioribus, stipulis multo longioribus caudato-acuminatis, floribus minoribus differt; ab *A. longistipulata* Riley foliis minoribus membranaceis vix coriaceis, floribus femineis multo minoribus, ovario truncato-globoso haud obovoideo recedit.

Frutex diffusus. *Ramuli* teretes, 2–3 mm. diametro 15 cm. infra apicem, glabri, brunnei. *Folia* elliptica vel lanceolata, 5.5–17.5 cm. longa, 2–6.5 cm. lata, integra, acuminata, basi in petiolum cuneatim angustata, membranacea, utrinque glabra, obscura, subtus pallidiora, costa supra versus apicem elevata versus basin plana vel subimpressa subtus omnino elevata, nervis lateralibus utrinsecus 10–14 arcuatis marginem haud attingentibus anastomosantibus utrinque elevatis; petioli 4–9 mm. longi. *Stipulae* anguste triangulares, interdum ovatae, caudato-acuminatae, 0.7–1.5 cm. longae, 1.5–5 mm. latae. *Flores masculi* 1–5-fasciculati, ad summos ramulos inter folia paris terminalis umbellatim dispositi, subsessiles. *Calyx* cupulatus, 4 mm. altus, 4 mm. diametro, minute 5-dentatus, extra subpuberulus, intus glaber. *Corolla* extra puberula, alba, tubo 1.6 cm. longo basi 2 mm. apice 3.5 mm. diametro, lobis 5 ovato-lanceolatis caudato-acuminatis 1.2 cm. longis 0.5 cm. latis. *Stamina* supra medium tubi inserta; filamenta minutissima; antherae lineares, 8.5 mm. longae, 0.5 mm. latae, apice acutae, basi subtruncatae, glabrae. *Stylum abortivum* 1.5 cm. longum, integrum. *Flores feminei* solitarii, pedicellati, pedicello 1.5 mm. longo, ut flores masculi dispositi. *Calyx* cupulatus, 3.5 mm. altus, 4.5 mm. diametro, minute 6-dentatus, extra inferne puberulus superne subpuberulus, ciliatus. *Corolla* extra et intus puberula, tubo 9 mm. longo apice et basi 3 mm. medio 2.75 mm. diametro, lobis 5 ovato-lanceolatis caudato-acuminatis 1.3 cm. longis 3.25 mm. latis. *Stamina abortiva* 5; filamenta 0.75 mm. longa; antherae fusiformes, 5 mm. longae. *Ovarium* truncato-globosum, 3 mm. diametro, puberulum;

stylus glaber, usque ad ramos 6.6 mm. longus, ramis tribus 5 mm. longis acutis. *Fructus* haud visus.

PANAMA: between Panama and Sabanas, fl. June, *Riley* 111 (type in Herb. Kew.)

***Psychotria bimea* Riley**, sp. nov. [Rubiaceae—Psychotrieae]; affinis *P. albae* Ruiz et Pav., a qua foliis plerumque basi cordatis rarissime in petiolum angustatis, petiolis multo brevioribus puberulis haud glabris, inflorescentiis minoribus, calycis lobis conspicuis valde acuminatis differt.

Frutex debilis. *Ramuli* ascendentes, graciles, subcompressi, 2 mm. diametro 15 cm. infra apicem, cinerei, glabri. *Folia* plerumque elliptica, interdum ovata, rarius obovata, 5–10 cm. longa, 1.7–5 cm. lata, cuspidata, acuta vel obtusa, basi cordata vel rotundata, interdum cuneata, glabriuscula, obscura, subtus pallidiora, costa supra caniculata glabra subtus elevata puberula, nervis lateralibus utrinsecus 7–10 arcuatis anastomosantibus supra subelevatis saepe mesophyllo pallidioribus subtus valde elevatis minute puberulis; petioli 1.5–4 mm. longi, puberuli. *Stipulae* ovatae, acutae, rarius obtusae, 5–6.5 mm. longae, 2–4 mm. latae. *Inflorescentiae* terminales, umbellatim 5-ramosae, minute puberulae, rhachi primaria 2–3.2 cm. longa, secundariis 0.5–1.1 cm. longis; bractae ovatae, acutae, 1.5 mm. altae, fere 2 mm. latae; pedicelli 0.5–0.75 mm. longi. *Tubus calycis* brevissimus, 0.25 mm. altus, lobis 5 anguste triangulato-acuminatis fere 0.75 mm. longis sparse ciliatis. *Tubus corollae* circiter 3 mm. longus, lobis triangulatis 1.5 mm. altis 1 mm. latis obtusis. *Antherae* subellipticae, 0.75 mm. longae, 0.25 mm. latae. *Ovarium* ovoideum, 1.5 mm. altum, 1 mm. diametro, puberulum; stylus flexuosus, 2 mm. altus, puberulus, sursum incrassatus, bifurcatus, ramulis 0.25 mm. longis. *Fructus* haud visus.

PANAMA: between Panama and Sabanas, fl. June, *Riley* 112 (type in Herb. Kew.); Empire Station, fl. Oct., *Sutton Hayes* 339.

***Rauwolfia multiflora* Riley** sp. nov. [Apocynaceae—Plumerieae]; affinis *R. canescenti* var. *glabrae* Muell. Arg., sed foliis maioribus late obovatis vel subrhomboideis haud ellipticis vel oblongo-ellipticis, inflorescentiis 20–50-floris nec 1–5-floris, laciniis calycis haud ciliatis differt.

Frutex. *Ramuli* teretes, satis robusti, fere 3 mm. diametro 15 cm. infra apicem, viridi-brunnei lenticellis pallidioribus conspicuis. *Folia* terna vel quaterna, verticillata, valde inaequalia, late obovata vel subrhomboidea, maiora 6–10 cm. longa, 3–5.5 cm. lata, minora 2–3 cm. longa, 1–2.5 cm. lata, valde acuto-cuspidata, basi cuneata, omnino glabra, supra obscura, subtus aliquanto pallidiora, costa et nervis lateralibus supra impressis subtus elevatis, illis in foliis maioribus utrinsecus 10–12 in minoribus 6–7 arcuatis rete venularum subtus forte conspicuo; petioli 2–7 mm. longi, glabri, supra caniculati, foliis minoribus nonnunquam subsessilibus. *Inflorescentiae* axillares, oppositae, pluries ramosae, 20–50-florae,

glabrae, axibus primariis 1.2-3 cm. longis; bracteae subulatae vel anguste triangulatae, acutae, circiter 1 mm. longae; pedicelli 2-2.5 mm. longi. *Calyx* late cupulatus, 1 mm. altus, 2.5 mm. diametro lobis rotundatis integris. *Corolla* alba, hypocrateriformis, 3.25 mm. longa, 5-loba; tubus 2 mm. longus, 2.25 mm. diametro, 10-nervius; lobi ovati, subacuti, integri, 1.25 mm. longi. *Stamina* 5, in faucem corollae inserta; filamenta minutissima; antherae liberae, sagittatae, apiculatae, 0.75 mm. longae. *Ovarium* subrhomboideum, disco 0.5 mm. alto cinctum, circiter 0.75 mm. diametro; stylus fere 1.5 mm. longus, capitatus, bilobus, acutus. *Fructus* haud visus.

PANAMA: Cocoli, opposite Balboa, 15 m., fl. June, Riley 125 (type in Herb. Kew.).

I have not seen the type of *R. canescens* var. *glabra*, but from the description that is evidently the affinity of *R. multiflora*. From it and from the other Central American material to which I have had access, the many-flowered inflorescences of *R. multiflora* are particularly distinctive.

Cordia panamensis Riley sp. nov. [Borraginaceae-Cordieae]; affinis *C. umbraculiferae* DC., sed ramulis et petiolis et pedunculis grosse hirsutis et scabris nec subpubescentibus, foliis maioribus plerumque longe acuminatis supra scabris nervis lateralibus pro rata pluribus petiolis brevioribus, floribus multo minoribus differt.

Arbor 6 m. alta. *Ramuli* satis robusti, sulcati, scabri et hirsuti. *Folia* inter maiora ovata vel elliptica (rarius fere rotunda), 20-27 cm. longa, 9-13 cm. lata, plerumque longe et graciliter acuminata, basi oblique rotundata vel cuneata, marginibus subundulata, supra scaberrima, subtus molliter pilosa, nervis lateralibus utrinsecus 11-13 supra cum costa tantum conspicuis subtus cum rete venularum valde manifestis; folia rotunda circiter 10 cm. diametro, apiculata vel breviter cuspidato-acuminata; petioli 0.8-1.2 cm. longi. *Inflorescentiae* laxae et dichotome ramosae, circiter 10-15 cm. longae, 15 cm. latae, rhachi primaria 2.5-5.5 cm. longa. *Alabastra* ad apicem rhachillarum conferta, obovoidea 2.5 mm. longa, molliter ferrugineo-pubescentia. *Flores* subsessiles, viridialbi. *Calyx* 3.5 mm. altus lobis triangulatis acutis vel subobtusis 1 mm. altis basi 1.25 mm. latis inclusis. *Corollae tubus* 3 mm. altus, glaber; lobi 2 mm. longi, basi 1.5 mm. lati, subtruncati, emarginati, reflexi. *Filamenta* 2 mm. longa, basi barbata; antherae 0.75 mm. longae, 1 mm. latae. *Ovarium* ovoideum, 1.5 mm. altum, 1 mm. diametro, glabrum; stylus 1.5 mm. altus ramulis inclusis, stigmatibus vix capitatis. *Fructum* non vidi.

PANAMA: secondary growth at sea-level near Old Panama, fl. June, Riley 143 (type in Herb. Kew.); Panama, fl. June, Sutton Hayes 89.

Solanum Coibae Riley, sp. nov. [Solanaceae-Solaneae]; affinis *S. tristi* Jacq., foliis plerumque brevioribus, inflorescentia

longius pedunculata, pedicellis longioribus et gracilioribus, corolla maiori lobis acuminatis glabris haud puberulis inter alia differt.

Frutex robustus, 2.4 m. altus. *Ramuli* subflexuosi, teretes, 3.25 diametro 15 cm. infra apicem, fusci, glabri. *Folia* membranacea, elliptica, interdum inaequaliter gemina, maioribus 5-15 cm. longis 2.5-6 cm. latis, minoribus 1.4-6.5 cm. longis 0.9-4 cm. latis, breviter cuneatim acuminata, basi acute cuneata, in petiolum oblique angustata, margine subrevoluta leviter undulata, utrinque nitidula, glabra, fasciculis minutis pilorum subtus in axillis nervorum lateralium exceptis, costa valida supra impressa vel applanata subtus elevata, nervis lateralibus utrinsecus 8-12 forte arcuatis anastomosantibus, rete venularum supra haud conspicuo subtus satis manifesto; petioli 0.8-1.5 cm. longi, glabri. *Inflorescentiae* foliis oppositae, 8-17-florae, glabrae; pedunculus 1.6-4.5 cm. longus, parte inferiori nuda 0.8-1.6 cm. longa; pedicelli graciles, arcuati, deflexi, 0.7-1.9 cm. longi. *Alabastra* ovato-elliptica, obtusa, 1.1 cm. longa, 0.6 cm. lata, lineis 5 fuscis notata. *Calyx* rotata, subcarnosa, fere integra sed vero dentibus callosis minute 5-dentata, 4 mm. diametro, glabra. *Corolla* alba, ad basin divisa, lobis 5 anguste triangulato-ovatis 1.2 cm. longis fere 0.5 cm. latis subacutis carnosis marginibus submembranaceis. *Stamina* 5, in tubo brevissimo circiter 0.25 mm. alto connata; filamenta vix 0.25 mm. longa, fere 0.5 mm. lata; antherae oblongae, 5.5 mm. longae, 2 mm. latae, obtusae, poris apicalibus 1 mm. longis. *Ovarium* bilobum, ovatum, 1.75 mm. altum, 1.25 mm. diametro; stylus erectus, cylindricus, 7 mm. longus, 0.5 mm. diametro, apice integro. *Fructus* haud visus.

PANAMA: Coiba Island, fl. Sept. *Collenette* in Riley 473 (type in Herb. Kew.).

***Acalypha Hicksii* Riley** sp. nov. [Euphorbiaceae-Crotoneae]; forsan affinis *A. Wilkesianae* Muell. Arg., sed foliis tenuiter membranaceis cordatis, stipulis 6 mm. longis haud 15 mm. longis omnino filiformibus nec lineari-lanceolatis, petiolis 6 cm. longis nec 1-3.5 cm. longis gracilibus haud validis differt.

Frutex circiter 1 mm. altus. *Ramuli* graciles, 2.5 mm. diametro 10 cm. infra apicem, sulcati, cinerei, molliter pubescentes. *Folia* tenuiter membranacea, ovata, 11-14 cm. longa, 6-9 cm. lata, acute acuminata, saepe mucronata, leviter cordata, obtuse dentata, dente quoque saepius apice unisetoso, parte marginis quinta inferiori undulata tantum, costa supra applanata vel versus apicem subelevata subtus elevata, nervis lateralibus utrinsecus saepissime 8 interdum 9 basi palmatim dispositis superne penninerviis ascendentibus utrinque elevatis anastomosantibus cum rete venularum fortiter conspicuis nervo quoque basali externe arcuato-ramoso, supra sparsissime setosa, nitidula, viridia, in sicco utique albo-marginata, subtus glabra, costa inferne puberula excepta, utrinque crebro elevato-punctata; petioli graciles, 4.5-7 cm. longi, pubescentes. *Stipulae* filiformes, 6 mm. longae, minute setulosae.

Inflorescentiae femineae axillares, graciles, laxae 4-6-florae, rhachi circiter 5-5.5 cm. longa pubescenti; bractea late ovata, 7 mm. longa, 1 cm. lata (ad apices dentium mensuris), subhastata, inaequaliter 12-dentata, dentibus anguste triangulatis acutis plerumque 2 mm. longis basi 1 mm. latis, palmatim 9-nervia, utrinque sparsissime setosa. *Ovarium* globosum, 1.25 mm. diametro, dimidio superiori albido-setoso; styli 3, circiter 7 mm. longi, glabri, stylo quoque circiter 16-ramoso ramis filiformibus interdum iterum ramosis 3-5 mm. longis, ramulis 0.75-2 mm. longis. *Fructus* haud visus.

COCOS ISLAND: in marshy ground near the sea shore, fl. Aug., *Hicks in Riley* 458 (type in Herb. Kew.).

I have suggested a possible affinity with *A. Wilkesiana* Muell. Arg. but material of that species from Fiji (the type locality) exhibits considerable difference both in general facies and in detail. I consider, however, that *A. Hicksii* must be referred to the same section, viz. *Palminerviae* Muell. Arg. in the series *Pantogynae-Pleurogynae* Muell. Arg. (Pax et Hoffm. in Engl. Pflanzenr. Euphorb.-Acalyphin. 13, 142: 1924).

Only one other species of *Acalypha* has been recorded from Cocos Island, *A. bisetosus* Bertero, collected by Stewart in 1906. (Proc. Calif. Acad. Ser. 4, i. 391: 1912). I have not seen any of this material but *A. bisetosus* belongs to quite a different section of the genus, viz. *Cuspidatae* Muell. Arg. of the series *Oligogynae* Muell. Arg.

XVI.—NEW SPECIES OF STRYCHNOS FROM TROPICAL AMERICA. T. A. SPRAGUE AND N. Y. SANDWITH.

The genus *Strychnos*, which includes the plants yielding nuxvomica and curare, comprises several hundred species described and undescribed. The only general account of *Strychnos* in Tropical America is Progel's revision in Martius, *Flora Brasiliensis*, vol. vi. pars 1, pp. 269-284, published in 1868. This includes descriptions of 31 species, of which 29 are natives of Brazil and Guiana, the two others being from Costa Rica and Amazonian Peru respectively. Since that date about 40 additional species of *Strychnos* have been described from Tropical America, and a new revision is now very much needed. Ten Brazilian species have been described by Barbosa Rodrigues alone (Vellozia, ed. 2, pp. 33-44: 1891) and thirteen (one from Guiana) by Gilg (Engl. Jahrb. xxv. Beibl. lx. pp. 36-42: 1898).

Over 60 species of *Strychnos* are now known from Brazil and Guiana. The genus is apparently much less richly represented in other parts of Tropical America, only 20 species being known, of which five are now described for the first time. Their distribution is as follows :—

MEXICO: *tepicensis* (West Coast) and *tabascana* (East Coast).

CENTRAL AMERICA: *longissima* (Guatemala), *Peckii* (British Honduras), *chlorantha* (Costa Rica), *darienensis* and *panamensis* (Panama).

WEST INDIES: *Grayi* (Cuba), *trinitensis* (Trinidad).

VENEZUELA: *Bredemeyeri* (nomen subnudum), *Curare*, *Fendleri*, *Gubleri*, *syntoxica*.

COLOMBIA: *hachensis*, *yapurensis*.

PERU: *brachiata*, *Poeppigii*, *Ruizii*, *tarapotensis*.

Most of these species have been collected only once, and their areas of distribution appear to be very limited. The apparent rarity of some of them, however, may be due to the difficulty experienced by collectors in obtaining flowering or fruiting material; as specimens in a sterile condition are as a rule insufficient for identification, they have not been collected except where they were supposed to be of economic importance. Detailed botanical investigation of these countries may be expected to increase the present total by at least 50 per cent.

The morphology of the vegetative members in *Strychnos* is interesting. Two homologous kinds of specially modified short-shoots are known. One type is a spirally-coiled tendril which arises in the axil of a foliage leaf or of a cataphyll, and the other, which appears to be confined (so far at any rate as the Tropical American species are concerned) to the Section *Breviflorae*, is a straight or curved spine. Both tendrils and spines are said to be present in a few species, e.g. *S. Castelnaii*, *S. nigricans* and *S. brasiliensis*. Of the new species described below, *S. syntoxica* (§ *Longiflorae*) has tendrils only, and *S. tarapotensis* (§ *Breviflorae*) has spines only. As might be expected, those species which bear spines but no tendrils assume the form of low much-branched bushes, whereas those which have both spines and tendrils appear to be partly straggling over other plants and partly climbing.

SPECIES MEXICANA.

***Strychnos* (§ *Longiflorae*) *tabascana* Sprague et Sandwith** sp. nov.; affinis *S. triplinerviae* Mart., e Brasilia, a qua foliis minus coriaceis longius acuminatis, corollis longioribus gracilioribus sparsius indutis, staminibus longius exsertis filamentis manifestis, fauce glabra differt; a *S. longissima* Loes., corollae indumento valde diversa.

Frutex verisimiliter scandens; ramuli hornotini gracillimi, pubescentes; ramuli annotini pubescentes, 2-3 mm. diametro; internodia 3-4.5 cm. longa. *Folia* ovata, ovato-lanceolata vel elliptico-lanceolata, acutissime acuminata, basi cordata rotundata vel etiam cuneata, 5-11.5 cm. longa, 2.7-4.8 cm. lata, utrinque costa nervisque lateralibus breviter pilosa, mesophyllo marginibusque pilis raris induta, nitidula, quintuplinervia, nervis tertiariis conspicuis subparallelis; petioli dense pubescentes, 3-5 mm. longi. *Inflorescentiae* ramulos breves paria foliorum 1-3 gerentes termin-

antes, et terminales et in axillis foliorum summorum corymboso-thyrsoideae; pedunculi pubescentes, cymarum terminalium 3.9 mm. longi, axillarium 8-12 mm. longi; cymulae ultimae triflorae, flore medio subsessili, lateralibus cum pedicellis dense pubescentibus 2-3.5 mm. longis; bracteae lineari-subulatae, dense pubescentes, 2-3.5 mm. longae. *Calycis segmenta* subulato-lanceolata, extra pilosa, longe ciliata, circiter 3 mm. longa. *Corolla* gracilis; tubus fulvus, pilis patulis adscendentibusque extra dense vestitus, intus albo-lanatus, parte suprema vix 3 mm. longa glabra excepta, 1.5-1.7 cm. longus, ad 1 mm. diametro; lobi dimidio superiore reflexi, lineari-oblongi, obtusi, extra pilosi, intus cinereo-pulverulenti, ad 4 mm. longi. *Stamina* summo tubo inserta, conspicue exserta; filamenta 1.5-2 mm. longa, glabra; antherae 1 mm. longae. *Ovarium* glabrum, 0.75 mm. diametro; stylus glaber, cum stigmate capitato 2-2.1 cm. longus, igitur fere ad 4 mm. e corollae fauce exsertus.

MEXICO. Tabasco; San Sebastian, fl. Feb. 16, 1889, *Rovirosa* 61 (type in Herb. Kew.).

SPECIES VENEZUELANAE

***Strychnos Fendleri* Sprague et Sandwith** sp. nov.; species foliis late ellipticis vel suborbicularibus breviter cuspidatis tantum subsessilibus supra nitidulis valde reticulatis, inflorescentia terminali dignoscitur.

Ramuli satis dense breviter pilosi, nodis incrassatis suberosis, internodiis 2.5-4.5 cm. longis. *Folia* fere sessilia plerumque late elliptica vel suborbicularia, rarius rhomboideo-elliptica, breviter acute vel obtuse cuspidata, basi rotundata vel obtusa, chartacea, quintuplinervia, supra lacte viridia nitidula valde crebre reticulata, subtus paullulo pallidiora, utrinque nervis marginibusque sparse breviter fulvo-pilosa, ceterum fere glabra, 3.5-6.8 cm. longa, 2-5.5 cm. lata; petiolus latus crassus dense breviter pilosus, 1-2 mm. longus, saepe 1.5-2 mm. latus. *Inflorescentiae* terminales, breviter thyrsoideae, ut ramuli dense breviter pilosae. *Sepala* vetusta sub fructu persistentia, triangulari-ovata, pubescentia, ad 1 mm. longa. *Bacca* laevis, brunnea, compressa, ad 2.3 cm. diametro; semina solitaria, late elliptica, 1.5 cm. longa, 1.2-1.3 cm. lata, 0.5 cm. crassa.

VENEZUELA. Miranda: Colonia Tovar, 1856-7, *Fendler* 2314 (type in Herb. Kew.)

The shape and reticulation of the leaves serve to distinguish *S. Fendleri* from all other Tropical American species known to us. *S. Bredemeyeri*, which comes from the same region, is practically a nomen nudum, all that is known of it being that the throat of the corolla is glabrous.

***Strychnos* (§ *Longiflorae*) *syntoxica* Sprague et Sandwith** sp. nov.; affinis *S. toxiferae* Schomb., foliis ovato-lanceolatis longius acuminatis multo minus hirsutis, utrinque costa nervisque lateral-

ibus pilis antrorsis subappresse hirsutis, marginibus ciliatis, ceterum glabriusculis differt.

Frutex scandens cirrhifer; rami ramulique teretes, annotini pilis ferrugineis patulo-ascendentibus dense hirsuti, hornotini graciles multo sparsius vestiti; internodia 2.5–5 cm. longa. *Folia* membranacea, ovato-lanceolata, satis longe (ad 1 cm.) acuminata, basi obtusa vel rotundata, 3.5–8.5 cm. longa, 1–3.2 cm. lata, utrinque nitidula, quintuplinervia, rete venularum conspicuo atque inter venulas minutissime punctulata, indumento ut supra descripto, pilis in costa faciei superioris atque in petiolo praecipue conspicuis; petioli 2.5–3.5 mm. longi; cirrhi ad 3 cm. longi, pilis ferrugineis subappressis dense vestiti.

VENEZUELA. Cassiquiare region: Rio Pacimoni; in woods at the foot of Cerro Imei, *Spruce* sine numero (type in Herb. Kew.). "One of the species used by the Cunipusana Indians in the fabrication of Curare".

Although neither flowers nor fruit are known, *S. syntoxica* is well-marked by its vegetative characters, and it has seemed desirable to describe it in view of the fact that it is used in the manufacture of Curare. It appears to be closely related to *S. toxifera*.

A description of Spruce's visit to the Cerro Imei is given in his "Notes of a Botanist on the Amazon and Andes" (ed. A. R. Wallace, 1908), vol. i. pp. 429–431. The locality does not appear to have been visited by any other botanist. It is marked on the map facing p. 486 in vol. i. of Spruce's "Notes of a Botanist".

SPECIES PERUVIANAE.

Strychnos (§ Longiflorae) Ruizii *Sprague et Sandwith* sp. nov.; affinis *S. brachiatae* Ruiz et Pav., petiolis gracilibus, foliis supra opacis rete venularum occulto, corolla longiore gracili differt.

Frutex ramulis subquadrangularibus pubescentibus 1.5–2.5 mm. diametro; internodia 3.5–4.7 cm. longa. *Folia* laevia, membranacea, ovato-lanceolata, acuminata, basi angustata, 5.5–8 cm. longa, 2.3–3.1 cm. lata, utrinque punctulis multis albis elevatis, nervis pilis subappressis sparsiuscule induta, ceterum glabra, quintuplinervia, supra opaca nervis et rete venularum occultis, subtus opaca pallidiora subtiliter reticulata; petioli satis dense pubescentes, 4–6 mm. longi. *Inflorescentiae* terminales, cymis dense corymboso-thyrsoideis, pedunculis pedicellisque brevibus pubescentibus; pedunculi circiter 1.5 cm. longi; bractae subulato-lanceolatae, pubescentes atque ciliatae, 2–5 mm. longae, *Calycis segmenta* lineari-lanceolata, acuta, 2.5–2.75 mm. longa, extra pubescentia, ciliata. *Corollae tubus* hypocrateriformis, extra densissime appresse fulvo-pilosus, intus subappresse villosus, 1.2 cm. longus, 1–1.5 mm. diametro; lobi anguste oblongo-lanceolati obtusi, extra sparse pilosi, intus cinereo-pulverulenti, ad 3 mm. longi. *Stamina* in fauce haud lanata fere sessilia; antherae e fauce exsertae, oblongae, 1.3 mm. longae. *Ovarium* glabrum, 0.5–0.8 mm.

diametro; stylus glaber, cum stigmate capitato ad 1.25 cm. longus, igitur e corollae fauce exsertus.

PERU. Without locality, *Ruiz* (type in Herb. Kew.).

Strychnos (§ Breviflorae) tarapotensis *Sprague et Sandwith* sp. nov.; affinis *S. brasiliensi* Mart., forma calycis segmentorum necnon nervis foliorum subtus glabris differt; a *S. Poeppigii* Prog., quae folia similia habet, inflorescentia laxiore floribus pedicellatis facile distinguitur.

Frutex spinosus, "tenuis, decussatim ramosus, ramis sub-sarmentosis haud volubilibus" (*Spruce*); ramuli tenues brevissime pubescentes, hornotini breves e nodis incrassatis surgentes 1.5–3 cm. longi, circiter 0.4 mm. diametro, pari foliorum atque inflorescentia una terminati; spinae nodis ramulorum annotinorum axillares, rectae, graciles, 0.5–1.3 cm. longae, basi 0.4–0.8 mm. diametro. *Folia* chartacea, ovata, abrupte longe obtuse acuminata, interdum apiculata, basi obtusa rotundata vel etiam subcordata, 1.5–5.4 cm. longa, 1–3 cm. lata, quintuplinervia, supra opaca olivacea nervis medio et lateralibus impressis breviter inconspicue pilosis, tertiariis linea punctorum elevatorum tantum notatis, ceterum glabra, subtus pallidiora glaberrima nervis satis prominentibus et rete venularum vel occulto vel subtilissimo leviter impresso fusco; petioli brevissime pubescentes, 1–1.5 mm. longi. *Inflorescentiae* pedunculo communi gracili flexuoso brevissime pubescente 0.7–1.4 cm. longo, 3–30-florae, majores corymboso-thyrsoideae, 0.3–0.7 cm. longae, 0.5–1.2 cm. latae; bractae indumento simili, lineari-lanceolatae, ad 1.5 mm. longae. *Flores* virides (*Spruce*); pedicelli ad 1 mm. longi. *Calycis segmenta* ovato-lanceolata, 1 mm. longa, extra pubescentia, ciliata. *Corolla* infundibularis, extra minute puberula; tubus ad 1.5 mm. longus, 2 mm. diametro, intus glaber; lobi triangulares vel ovato-oblongi, 1–1.2 mm. longi atque lati, intus apice marginibusque dense lanati. *Stamina* apice tubi inserta, filamentis brevissimis; antherae 0.7 mm. longae, basi sparse lanatae. *Ovarium* globosum, 0.5 mm. diametro, glabrum; stylus basi parce brevissime pilosus, ceterum glaber, cum stigmate capitato circiter 8 mm. longus.

PERU. Amazons basin: Tarapoto, in thickets, fl. Oct. 1856, *Spruce* 4889 (type in Herb. Kew.).

SPECIES BRASILIANAE.

Strychnos (§ Longiflorae) asperula *Sprague et Sandwith* sp. nov.; affinis *S. rondeletii* Spruce, corollis haud pulverulentis fauce haud lanata, foliis minus coriaceis supra subtilissime tantum reticulatis nervis tertiariis inconspicuis differt.

Frutex scandens; ramuli hornotini ascendentes, graciles, glabri; annotini quadrangulares lenticellati cortice cinereo. *Folia* ovata vel elliptica, breviuscule acuminata, basi rotundata vel cuneata, 8–10 cm. longa, 3.8–5 cm. lata, tenuiter coriacea, utrinque vix nitidula, glabra, quintuplinervia, nervis tertiariis inconspicuis

sed rete venularum praesertim supra subtilissimo, supra punctulis elevatis creberrimis asperula; petioli graciles, 4-8 mm. longi, 0.75-1 mm. lati. *Inflorescentiae* terminales, cymis dense corymboso-thyrsoideis; pedunculi 1.5-2.5 cm. longi; rhachis ejusque rami pubescentes, floribus fere sessilibus; bractae connatae, ciliatae, 1-2.5 mm. longae. *Calyx* segmentis rotundato-ovatis obtusis ciliatis 0.75 mm. longis. *Corolla* ochroleuca; tubus hypocrateriformis, utrinque glaber, fauce haud lanata, 8.5 mm. longus, 0.5-0.75 mm. diametro; lobi patentes vel subreflexi, lineari-lanceolati, 2.5 mm. longi, obtusi, intus praesertim marginibus atque apicem versus cinereo-pulverulenti. *Stamina* in fauce inserta, filamentis brevissimis; antherae e fauce exsertae, 1.75 mm. longae. *Ovarium* glabrum, circiter 0.5 mm. diametro; stylus glaber, cum stigmate capitato 1 cm. longus. *Fructus* ignoti.

BRAZIL. Amazons basin: Rio Acre; Seringal San Francisco, fl. Sept. 1911, *Ule* 9838 (type in Herb. Kew.).

Strychnos (§ Longiflorae ?) panurensis *Sprague et Sandwith* sp. nov.; a *S. cogente* Benth., ramulis minutissime tantum pilosulis, foliis plerumque revere lanceolatis atque longioribus supra nitidis pulcherrime et minus subtiliter reticulatis mesophyllo epunctato differt; a *S. smilacina* Benth., forma foliorum, rete venularum subtiliore, primo visu distinguitur.

Frutex scandens; ramuli quadrangulares inconspicue costati sub lente minutissime pilosuli vel glabrati densiuscule lenticellati 2-3 mm. diametro; internodia 2.5-4.5 cm. longa; nodi incrassati ad 7 mm. lati. *Folia* lanceolata vel ovato-lanceolata, obtusiuscule acuminata, basi rotundata, 12.5-15.5 cm. longa, 3.8-5.8 cm. lata, coriacea, supra nitida, valde quintuplinervia, rete venularum conspicuo, mesophyllo epunctato, utrinque glabra; petiolus crassus 6-7 mm., longus, circiter 2 mm. latus. *Inflorescentiae* axillares, thyrsoideae, dense minute pubescentes, 1.8-4.5 cm. longae; bractae ovatae vel lineari-lanceolatae, dense pubescentes, 2-5 mm. longae; pedicelli 2-3.5 mm. longi, sub fructu sursum incrassati. *Flores* post lapsum corollae tantum visi. *Calycis segmenta* sub ovario vetusto ovato-lanceolata, ad 1.6 mm. longa, ciliata, extra pubescentia, intus glabra. *Ovarium* glabrum, ad 1.5 mm. diametro. *Bacca* laevis, siccitate ochracea, 1.3-1.5 cm. diametro; semina solitaria, suborbicularia, circiter 1.3 cm. longa, 1.1 cm. lata, circiter 3 mm. crassa.—*S. cogens* Prog. in Mart. Fl. Bras. vi. pars 1, 275 (1868), partim, non Benth.

BRAZIL. Rio Negro basin: near Panure by the Rio Uaupes, in "gapo", October 1852, *Spruce* 2634 (type in Herb. Kew.). "Twiner and climber; fruits yellowish, succulent."

Strychnos gigantea Barb. Rodr. (Vellozia, ed. 2, i. 37: 1891) from near Moura, Rio Negro, which was based on material without flowers or fruits, may be nearly related. It seems to differ, however, in having elliptic-oblong leaves, apparently not shining on the upper surface (a character mentioned by Barbosa Rodrigues for other

species described by him at the same time), and with much less regular and parallel tertiary nerves according to his figure.

XVII.—MA HUANG OF CHILI. (*Ephedra sinica* Stapf).
O. STAPF.

The term Ma huang (hemp-yellow, * apparently in allusion to the yellowish male flowers), was applied to species of *Ephedra* as early as the 2nd century B.C. if not earlier. That it was a general term is evident from the fact that the references to Ma huang in the Chinese literature cover a wide area with more than one species. Recently, however, a plant of a definite northern origin, namely Chili, has come into the market under that name. To this plant various scientific names have been applied such as *Ephedra helvetica*, *E. intermedia*, *E. equisetina* etc. So far no verification of these determinations has been possible as the material obtained consisted merely of fragments of stems. More recently, however, a good supply of complete plants, though without flowers or fruits, was received at Kew from Messrs. Parke, Davis and Co., Detroit, Mich., U.S.A. They represented small shrublets of very uniform habit and of a facies which is not compatible with any of the known species of *Ephedra*. They were so characteristic that I did not hesitate to give them a provisional new name; viz. *E. sinica*. Immature and mature galbules together with fragments of stems, conforming to the original samples, have now come to hand from the same source, and they leave no doubt as to the specific distinctiveness of the specimens, an all but complete description of which is given below. Only the male flowers remain unknown; but these are not likely to yield any important diagnostic characters.

F. Porter Smith, in his "Contributions towards the Materia Medica and Natural History of China" p. 93 (1871) has already referred to Ma huang and proposed for it the name *Ephedra flava*; but as this name is not accompanied by a description and was, in the first place, intended for a Honan plant, undocumented by any specimens, it is very doubtful and it should therefore not be used. As the Ma huang of Honan has from early times had the reputation of being the best of its kind, it seems desirable to ascertain its identity. A search in the hilly districts immediately south of the Hoangho from the Shensi frontier towards Kai feng fu, the capital of the province, would no doubt soon reveal the nature of the valued drug.

***Ephedra sinica* Stapf** spec. nov.; cum *E. distachya* L., (praecipue eius f. *monostachya* cui habitu similior) et cum *E. equisetina* Bunge, comparanda, sed ab utraque ramorum internodiis infimis eximie ancipitibus, foliorum laminis subulatis saepe recurvis distat; praeterea ab *E. distachya* differt ramis laevibus, galbulo-
bracteis inferioribus intermediisque acutioribus summis in utriculorum

* Bretschneider, Bot. Sin. iii. 180 (1895).

oblongo-ellipticum minus alte fissum connatis, ab *E. equisetina* habitu et galbulis 2-floris vel 2-spermis paulo minoribus.

Frutex ad 30 cm. altus, rarius altior, e basi ipsa caespitose multiramatus; rami simplices vel sparse divisi, ramulis basi per internodium primum vel altius conspicue ancipitibus longis erectis; rami ramulique tactu laeves, tenuiter striati, internodiis 3-5 cm. longis 1-1.5 mm. diametro. *Foliorum vaginae* ad 2 mm. altae, tenues, ad commissuras membranaceae et mox secundum eas fissae, basi circumcirca incrassatae, hic vel fere totae brunnescentes, caeterum albiae; *laminae* rudimentariae, subulatae, recurvulae, 1-3.5 mm. longae, virides vel brunnescentes. *Spicae* ♂ ignotae. *Galbuli* ♀ 2-flori, uno flore interdum hebetato, subsessiles, pedunculo 1-1.5 mm. longo, juniores ovoidei, bractearum paribus 3 vel 4, raro 5. *Bracteae* infimae et intermediae ovatae, acutae vel subacutae, infimae 1-3 mm. longae, basi connatae, intermediae latiores et saepe ad vel ultra tertiam partem connatae, ad margines membranaceae, caeterum pallide vel luride virides, summae in utriculum oblongo-ellipsoideum per tertiam partem fissum connatae. *Tubillus* rectus, 1-2 mm. longus, exsertus. *Galbuli maturi* ellipsoideoglobosi, 6-8 mm. longi, bracteis carnosius rubris. *Semina* oblonga, 4.5 mm. longa, 2 mm. lata, subacuta, atro-brunnea, dorso laevisima, convexa, facie applanata vel subconcaeva, ad latera acute angulata.

CHINA borealis: Chili; Tanhwa, *F. N. Meyer* 1095; without exact locality, comm. *B. E. Read*; without exact locality, comm. Parke, Davis & Co. sub nomine "Ma Huang" (name-type).

In addition to the external characters described in the Latin description, I may say that the anatomical examination of the green branches shows the presence of (normally) 8 vascular strands and the complete absence of circummedullary fibres. Intercortical fibres may be present or absent, and tanin-sacs if present altogether, exhibit only a small amount of tanin, but as to this further observations are desirable. Cross-sections through branches of *E. sinica* resemble more those of *E. distachya*, than of *E. equisetina*.

XVIII.—ATYLOSIA OR CANTHAROSPERMUM. T. A. SPRAGUE.

The genus in question is assigned to the *Leguminosae*, tribe *Phaseoleae*, and comprises about 40 species from Tropical Asia, Australia, Madagascar and Mauritius. As it is currently known under two generic names, *Atylosia* Wight et Arn. and *Cantharospermum* Wight et Arn., it seems desirable to ascertain which of these is the correct name under International Rules.

The name *Atylosia* was adopted in the following works among others: Miq. Fl. Ned. Ind. (1855); Benth Fl. Austral. (1864); Benth. & Hook. f. Gen. Pl. (1865); Baill. Hist. Pl. (1870); Hook. f. Fl. Brit. Ind. (1876); Baker, Fl. Maurit. (1877); Boerl. Handl. Fl. Ned. Ind. (1890); Trimen, Fl. Ceylon (1894); Cooke, Fl.

Bombay (1902); Perkins, *Fragm. Fl. Philipp.* (1904); K. Schum. & Lauterb. *Nachtr. Fl. Deutsch. Schutzgeb. Südsee* (1905); Koord. *Exkursionsfl. Java* (1912); Lecomte, *Fl. Gén. Indo-Chine* (1916); Gamble, *Fl. Madras* (1918); Ridley, *Fl. Mal. Penins.* (1922); Domin in *Biblioth. Bot.*, Heft 89, 227 (1926).

The name *Cantharospermum* has been adopted by Taubert in *Engl. & Prantl. Nat. Pflanzenfam.* (1894); Dalla Torre & Harms, *Gen. Siphonog.* (1901); Thonner, *Blütenpfl. Afr.* (1908); Merrill in *Philipp. Journ. Sc., Bot.* v. 127 (1910); Merrill, *Fl. Manila* (1912), *Species Blancoanae* (1918), *Enum. Philipp. Fl. Pl.* (1923).

The two competing names were published in the same work and at the same date by Wight and Arnott (*Prodr. Fl. Pen. Ind. Or.* 255, 257: 1834), *Cantharospermum* being on p. 255 and *Atylosia* on p. 257. Taubert apparently chose *Cantharospermum* because of this "priority of place". Merrill (*Philipp. Journ. Sc. Bot.* v. 128: 1910) remarked that "the generic name *Cantharospermum* W. & A. has only page preference over *Atylosia* W. & A., and the latter is by far the more commonly used one. The fact that *Atylosia* was not included in the list of *nomina conservanda* of the Vienna Botanical Congress is an excellent illustration of the inconsistency of that list". This appears to have been written under a misapprehension. "Priority of place" is not recognized in the International Rules. Under Art. 46, the first author who united *Atylosia* and *Cantharospermum* was at liberty to choose either of the names, and his choice cannot be modified by subsequent authors. Bentham (*Pl. Jungh.* ii. 242: 1852) appears to have been the first to unite the two genera, and he adopted the name *Atylosia*. Hence *Atylosia* is the correct name under the Rules (unless it can be proved that the two genera were united previously by an author who chose *Cantharospermum*), and it is therefore unnecessary to place it on the list of *nomina conservanda*.

XIX.—MISCELLANEOUS NOTES.

MR. A. G. TANSLEY, M.A., F.R.S., Trinity College, Cambridge, has been elected to the Sherardian Professorship of Botany in the University of Oxford.

The following appointments have been made by the Secretary of State for the Colonies:—Mr. T. McEWEN, B.Sc., to be Senior Agricultural Research Officer, Northern Rhodesia; Mr. J. W. NICHOLSON, to be Adviser of Forestry, Kenya and Uganda.

MISS MATILDA SMITH.—This lady, whose death on December 29, in the 73rd year of her age, it is our sad duty to announce, was the well-known botanical artist who for 44 years was intimately associated with the Royal Botanic Gardens, Kew.

Miss Smith was born in Bombay on July 30, 1854, and came to England in her infancy. She was the second daughter of the late Mr. James Smith, of Sydenham, and her mother was the youngest of the many children of Edward Rigby, M.D. (1747-1821), of Norwich, a distinguished physician and evidently a public spirited man of considerable ability and many interests. Dr. Rigby's second wife, Miss Smith's grandmother, was the sister of Mrs. Dawson Turner, the wife of the antiquary and botanist. Maria, a daughter of Dawson Turner, married William Jackson Hooker. It will be seen, therefore, that Miss Smith was second cousin to Sir Joseph Dalton Hooker.

The beginning of Miss Smith's career as an artist may be traced to the loss which Sir J. D. Hooker, as editor of "Curtis's Botanical Magazine," had sustained in the withdrawal, in 1877, of the services of his draughtsman, the talented Walter Hood Fitch, who had prepared most of the plates for the Magazine since 1834.

Hooker invited his young cousin, who, he knew, was fond of and possessed some skill in drawing, to come to Kew, with the view of being suitably trained to take Fitch's place. The invitation accepted, Hooker himself, a draughtsman of real ability, undertook the direction and supervision of her studies. Both tutor and pupil could be congratulated on the results. The difficult situation that arose in consequence of Fitch's secession was eventually overcome, though, perhaps, never entirely to Miss Smith's satisfaction, for in later years in expressing, as she often did, her admiration of her predecessor's work she regretfully spoke of her inability to emulate it.

Miss Smith's first contribution to the "Botanical Magazine" appeared as plate 6386 in October, 1878. This was a drawing of *Hedysarum Mackenzii*. Two other plates by her were published later in the same year. To the volume for 1879 she contributed 18 plates, to that of 1880, 26, and so on, each year her share of the work increasing, till in 1887 all the 60 plates in the volume were prepared from her drawings. From 1887 Miss Smith was practically sole artist of the "Botanical Magazine," and continued so till its temporary suspension at the end of 1920. After the resumption of publication in 1922 five of her drawings were issued, the last being on plate 8948 (*Malus toringoides*), published in February, 1923. It is estimated that Miss Smith contributed about 2300 plates to the Magazine, Fitch, 2900, and Sydenham Edwards, about 1700; the three of them, therefore, made the drawings for 6900 out of the total of 9055 plates so far published. Fitch's and Miss Smith's connection with the Magazine covered in all about 88 years, this long period being shared nearly equally between them.

Another publication with which Miss Smith's name has for many years been associated is "Hooker's Icones Plantarum," which contains drawings and descriptions of plants selected from the Herbarium. Her earliest contribution to this was plate 1354

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(*Indigofera trachyphylla*). Bentham showed his appreciation of Miss Smith and her work by placing in the hands of trustees a sum of money destined for the purpose of carrying on the *Icones* and of employing Miss Smith as artist for the publication so long as she cared to fill that post. With the exception of 100 plates of ferns, by John Allen, contained in vol. xvii, and a few in the last part issued, Miss Smith was artist and lithographer for all the 1747 plates published in the *Icones* since October, 1881.

Among the other publications for which Miss Smith supplied all or part of the illustrations the more important are:—Hemsley's "Report on the scientific results of the voyage of H.M.S. 'Challenger' Botany," 1885 (most of the 65 plates in vol. i, pts. 1-3); Oliver's "Botany of the Roraima Expedition," 1887, in *Trans. Linn. Soc.* ser. 2, ii. (16 plates); Balfour's "Botany of Socotra," 1888 (57 plates); Aitchison's *Botany of the Afghanistan Delimitation Commission*," 1888, in *Trans. Linn. Soc.* ser. 2, iii. (39 plates); Collett's "Flora Simlensis," 1902 (200 pen-and-ink drawings in the text); Johnston's "Liberia," 1906 (24 full-page illustrations); Watt's "The wild and cultivated cotton plants of the world," 1907 (21 plates); Hemsley's "On the Julianaceae: a new natural order of plants," 1907, in *Phil. Trans. R. Soc. Lond.* ser. B, cxcix. (7 plates); and Cheeseman's "Illustrations of New Zealand plants," 1915 (251 plates). A large number of the plates are of quarto size and with two exceptions all are uncoloured. Amongst them there is much excellent work. Miss Smith was fortunate in having many of her drawings put on stone by some of the best lithographers of the time, including Mr. John Nugent Fitch.

Plates or text-figures bearing the familiar "M.S. del." or "M. Smith del." may be met with in numerous other publications, botanical or horticultural, independent or periodical. She also prepared a great number of drawings of living or dried plants which were not intended for publication but for preservation in the collection of plant portraits in the Herbarium.

On many occasions Miss Smith made facsimiles of plates required to complete imperfect volumes in the library. Her skill in doing this was remarkable. She supplied in facsimile a missing plate in Miss Mary Lawrance's valuable work: "A collection of Roses from Nature," 1799, and 9 missing plates in Trew's "*Hortus nitidissimis. . . floribus*," 1750-72, as well as many other plates, usually coloured. Her neat penmanship was often employed in making copies of titles and pages of text in which certain rare volumes were deficient.

Miss Smith had a taste for authorship which, however, could be exercised but to a very small extent in her official capacity. It gave her much gratification to contribute to the *Kew Bulletin* (1916, pp. 164-168) some notes on botanical artists, specimens of whose work were exhibited in a room of the North Gallery.

Though intimately associated with the Royal Botanic Gardens, Kew, for little short of half a century, and during this long period

usually regarded as the artist of the establishment, which depended almost entirely on her pencil for the illustrations it required, Miss Smith was not appointed official artist till April 1, 1898. Even then she was officially employed for only two days a week. This arrangement enabled her to continue her work on the "Botanical Magazine" and "Hooker's Icones Plantarum," and to undertake commissions for many unofficial publications, some of which have already been mentioned. It gave her opportunities also to afford help of various kinds, often representing the sacrifice of much of her time, to many who visited the Herbarium, and to take an active part in local affairs. She was a much valued member of the Richmond Board of Guardians and was Treasurer and Sub-editor of the Kew Parish Magazine, which she managed most successfully.

It is a fitting occasion to recall a few of the many expressions of praise of Miss Smith's drawings that have been elicited from authors by whom she was employed. Sir Henry Collett refers to her "beautiful and characteristic illustrations" and "the great pains she has taken to produce artistic and accurate representations." Sir George Watt wrote: "I take the opportunity to acknowledge the untiring efforts of Miss Smith to secure accuracy in detail combined with artistic delineation." The late Dr. W. Botting Hemsley, from 1899 to 1908 Keeper of the Herbarium and Library, under whose direction a considerable part of Miss Smith's drawing was done, commenting on her work for "Hooker's Icones Plantarum" said: "The excellence of these drawings, with very full floral analyses, is generally acknowledged, and they present a permanent record of Miss Smith's skill in re-animating dried, flattened specimens, often of an imperfect character." The late Mr. Thomas Cheeseman expressed his appreciation of Miss Smith's drawings in his "Illustrations of New Zealand plants" in the remark: "I think that all capable judges will agree with me in saying that the plates contained in these volumes will enhance her already well-earned reputation."

In 1916 Miss Smith was President of the Kew Guild, an organisation to which belong all who are, or have been, employed in positions of responsibility in the Royal Botanic Gardens, Kew. The President is elected from among the more distinguished of its members. So far Miss Smith has been the only lady who has filled the office, which she accepted not only as an honour but as an opportunity to render further service to the Guild, in which she was always keenly interested.

In November, 1921, Miss Smith was elected an Associate of the Linnean Society of London. Only one lady, a resident of South Africa, had previously been given this distinction. The announcement that the Council of the Royal Horticultural Society had awarded her one of the Silver Veitch Memorial Medals, with a sum of £25, "for her botanical draughtsmanship, especially in connection with the Botanical Magazine," was published in the "Gar-

deners' Chronicle'' bearing the date on which the funeral took place (January 1).

Two genera of plants have been named in compliment to Miss Smith. *Smithiantha* Kuntze (*Rev. Gen.* p. 977, 1891) was proposed in place of *Naegelia* Regel (*Gesneraceae*), as the latter name had previously been appropriated by Rabenhorst for a genus of Fungi. *Smithiella* Dunn (*Kew Bull.* 1920, p. 211, with fig.) is a genus of *Urticaceae* from the Abor Hills, Eastern Himalaya. The name of the only species, *myriantha*, "refers to its innumerable flowers as well as to the very large number of beautiful drawings and paintings with which Miss Smith has for so many years decorated the 'Botanical Magazine,' the 'Icones Plantarum,' and the 'Kew Bulletin.'"

We cannot in the space here available attempt even to mention all Miss Smith's activities or anything like all the interesting events of her life at the Herbarium and in Kew village. Her charm of manner, her quick and practical sympathy, freely given to all who sought it, and her rich store of knowledge of many kinds, which it delighted her to use for the benefit or pleasure of others, attracted around her a host of friends.

Miss Smith, like Miss Marianne North, might have written from her own experiences other charming "Recollections of a happy life." The happiness she sought she found in service to others, in devotion to duty, in going about doing good; and abundantly, we are sure, she found it.

Since her retirement, which took place on July 29, 1921, Miss Smith had two long and serious illnesses, the latter in the spring of last year. She recovered so far that she could resume much of her work. Her final illness was of short duration; thus, happily, she was spared a further prolonged period of suffering, inactivity and helplessness.

The great esteem in which Miss Smith was held found expression at her funeral on New Year's Day, when a service in Kew Church, preceding burial in Richmond Cemetery, was attended by a large number of local residents and others, representatives of the Richmond Board of Guardians, and many of the past and present members of the staff of the Royal Botanic Gardens, Kew.

A portrait of Miss Smith was published as a frontispiece to the "Journal of the Kew Guild" for 1916.

Botanic Gardens for Canada.—Except for the small and interesting Botanic Garden which is being developed in connection with the new University buildings of the University of British Columbia on the outskirts of Vancouver, B.C., the great Dominion of Canada unfortunately does not possess a Botanic Garden. Such an omission in this great country, where the Universities have attained a world-wide reputation, especially in the domains of

Science, is a matter of deep concern and regret to the Botanists of the Empire no less than to those of the Dominion itself.

Canada does not appear to have realised the importance of Botanic Gardens not only for their educational value for the proper display of the great wealth of the vegetable resources of the Dominion but also as centres where researches in the sphere of genetics and in the introduction and improvement of economic plants can be prosecuted.

It is to be hoped that the importance of this aspect of botanical knowledge has only been overlooked, owing to the rapid developments which have been taking place in so many other directions, and that the time is now approaching when the assistance which the science of Botany can render to a country will be more fully appreciated, and that time and opportunity will be found to consider the urgent needs of the science in order that she may fulfil her proper functions. The formation of one or many Dominion Gardens is one of the most pressing needs, and all the more urgent, in order that land suitable for the purpose may be secured before it can be irretrievably seized by the ever-spreading march of building operations near the University centres.

The Director when he visited Toronto in September, 1926, had the privilege of discussing the subject of Botanic Gardens with the President of the University, Sir Robert Falconer, K.C.M.G., and was able to emphasise the suitability of Toronto for a Botanic Garden, in connection with the School of Botany, worthy of the Dominion. It is gratifying to find that the President in his Report for the year 1925-26 makes special reference to the matter in the following terms:—

“In an annual survey it is only right that mention should be made of the special needs of the University. Of all the departments Botany is that which has been waiting longest for better equipment. For many years the great need of a Botanic Garden for this University and Province has been emphasised. In the neighbourhood of Toronto a suitable site may be obtained in which the national treasures may be displayed and their economic possibilities set forth. Recently the Director of the Royal Botanic Gardens at Kew has visited the city, and once again it has been brought to our attention that such a Garden is a necessity for the study of native vegetation, the preservation of native flora, and the promotion in the Dominion of economic developments similar to what has been so effectively done for years by Kew Gardens.”

The fulfilment of the President's aspirations will be eagerly awaited both by Botanists in Canada and in Great Britain, since in the chain of Botanic Gardens which exists throughout the British Empire the one and only link which is missing is that of the Dominion of Canada.

The Journal of the Botanical Society of South Africa.—Part xii, 1926, contains an interesting review of the National

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Botanic Gardens, Kirstenbosch. There is a welcome indication of steady and increasing public support both in membership of the Botanical Society and in private subscriptions. The annual attendance of visitors at the Gardens also shows a steady increase. It is gratifying, therefore, to notice the encouragement promised by the Union Government, who have now undertaken to contribute, on the pound for pound basis, to every gift and legacy donated to the Gardens. The Society is fortunate to be able to announce under this scheme the bequest of £2000 under the will of the late Dr. de Korte, of Cape Town. It is notified that the Harold Pearson Memorial Hostel, which was opened in 1925 for the benefit of women working at Kirstenbosch, is now generally able to provide accommodation for visitors to the Gardens. Progress in the development of the Karoo Garden at Whitehill is recorded and botanists have already visited the Garden and explored the surrounding country.

Besides the accounts of the Gardens and the work of the Botanical Society of South Africa there are several articles of local interest, and the illustrations show the Harold Pearson Memorial Hostel and typical views of the vegetation and flowers of South Africa.

The Flora of South Africa*.—The two parts into which volume ii. of Dr. Marloth's monumental work has been divided have now been received at Kew, and the opportunity is here taken to comment on the work, of which another volume (vol. iii. *Sympetalae*) has still to be published.

Dr. Marloth's first volume appeared in 1913, and dealt with the *Thallophyta*, *Archegoniatae*, *Gymnospermae*, and the first part of the *Dicotyledones*. Volume iv., containing the *Monocotyledones*, was published in 1915.

Dr. Marloth shows by a diagram on p. 118 of vol. i. his views as to the best phylogenetic arrangement of the principal groups of flowering plants. In this table he shows disagreement with the Engler and Prantl system by placing the *Monocotyledones* at the end. The sequence of the orders and families of the *Dicotyledones*, however, is after Engler and Prantl. Dr. Marloth retains the artificial group *Monochlamydeae*, determined by the presence of only one perianth-whorl, and may thus cause some confusion in the mind of the student, for in that group he includes such a petaliferous family as *Caryophyllaceae*, whilst he places the mostly apetalous family *Euphorbiaceae* in the *Dialypetalae*. Dr. Marloth's further views on the phylogeny of the families would have been welcome, as he evidently considers the *Euphorbiaceae* have no direct connection with any family of the *Geraniales*, as suggested by Engler and Prantl (see vol. ii. Sect. ii. p. 123).

* The Flora of South Africa, with Synoptical Tables of the Genera of the Higher Plants, by Rudolf Marloth. Cape Town: Dartar Bros. & Co. (1925). Vol. ii, pp. 272, plates 52+28, figs. 162. Price £5 5s.

The two parts of vol. ii. are well up to the high standard of the earlier volumes, and like them contain a wealth of beautiful photographs, coloured plates and other illustrations of the remarkable vegetation of South Africa. Dr. Marloth is to be warmly congratulated on the near completion of a work of marked originality which, while not claiming to be a complete "flora," should be the best possible basis for an introductory study.

J. H.

Sikkim Orchids.*—Professor Brühl's handy Guide to the orchids of Sikkim should prove to be a very useful book for those who desire to study the orchids of this much visited region. King and Pantling published their admirable monograph of the orchids of Sikkim over 25 years ago, but, largely on account of its size and cost, this important work is not readily available for general use. Dr. Brühl's book removes these difficulties and places in the hands of orchid lovers a condensed account of a popular nature which will be widely appreciated.

The text is arranged on the "key system" and technical terms are reduced to a minimum; keys are provided both for the genera and for the species, and they are both very fully drawn up and commendably clear. A few typographical errors have unfortunately escaped attention and the taxonomy is not always in accordance with modern practice; it is also to be regretted that a new genus *Cleistocentron* should be first described in a popular work. Otherwise this book can be warmly commended to the notice of orchid lovers, and it is to be hoped that Prof. Brühl's useful guide will stimulate a careful study of the orchid flora of Sikkim and that collections of ample material may be made for critical determination by orchidologists. For it must not be construed from the statements on pages v and vi of the Foreword that our knowledge of this group is in any way complete. In many of the genera much critical work yet remains to be done and the status of many of the so-called species is still extremely doubtful.

Enzymes†.—The biological importance of enzymes is now fully recognized, and this text-book should be of great use to all students of living plants and animals. It is a concise, well-arranged compilation. In their preface the authors state they have consulted over two thousand references, and in the Bibliography there are 1323 items, many of them giving more than one paper. The parts of special interest to botanists are those dealing with enzymes in biological processes, plant enzymes, enzymes of micro-

* A Guide to the Orchids of Sikkim, by Paul Brühl. Thacker, Spink & Co., Calcutta and Simla, 1926. Pp. xvi+208, one text figure. Pocket size.

† Enzymes, by S. A. Waksman and W. C. Davison. Baillière, Tindall and Cox, 7 & 8, Henrietta Street, Covent Garden, London, 1926. Pp. xii+364, figs. 10. Price 25s.

organisms, and the details concerning the occurrence, action, and preparation of the enzymes acting upon the various groups of organic substances which form the chemical basis of plant life. The chapter on the uses of enzymes indicates how, in many ways unknown to the general public, scientific research in biochemistry is closely linked with all aspects of modern civilization.

W. B. T.

A Manual of Plant Breeding for the Tropics.*—This volume constitutes, as pointed out in the foreword, the first of a series of agricultural science texts for use in the Philippines and in the Tropics, prepared by the College of Agriculture of the University of the Philippines. The first few chapters are devoted to the general principles of and the methods employed in plant breeding, after which a special chapter is devoted to the genetics of each of the main crops of the Philippines, such as Rice, Abaca (Manila Hemp), Sugar Cane, Maize, Tobacco and Coconuts. This is followed by a general account of the improvement of minor Philippine crops, which include Cassava, Coffee, Rubber, Cocoa, Cotton, Sweet Potato and others. In addition to crops, fruits and ornamental plants are dealt with. Under the former heading interesting accounts of recent work on the banana and pawpaw (*Carica Papaya* L.) are given; other tropical fruits, including Citrus, are dealt with in less detail. In the discussion on ornamental plants work done on the various ornamental *Hibisci* receives special attention, and interesting information on the production of new seedling varieties of the common Croton (*Codiaeum variegatum* L.) Blume) and on the results of Rosal (*Gardinia florida* L.) breeding in the Philippines is included.

The book, consisting of 265 pages with numerous illustrations, should be extremely useful to all engaged in plant breeding work in the Tropics. For though intended primarily as a student text-book the field covered is so wide, and the most recent information concerning many of the crops is presented in such detail, that the book is likely to have a far wider range than that claimed for it by the author. As tropical plant breeding is dealt with exclusively the work is quite one of the pioneers of its kind, and should be appreciated as a botanical and agricultural text-book for use in colleges throughout the Tropics. A useful bibliography is incorporated at the end of the work.

Conifers, Junipers and Yews: Gymnosperms of British Columbia.†—This is the first of a contemplated series of six volumes

* A Manual of Plant Breeding for the Tropics, by N. B. Mendiola, Bureau of Agriculture. Published by the Bureau of Printing, Manila, Philippines, 1926, pp. 365, numerous ill.

† Conifers, Junipers and Yews, by John Davidson, with drawings by Miss Ivy Abercrombie. T. Fisher Unwin Ltd., (Ernest Benn Ltd.), Bouverie House, Fleet Street, London, 1927; pp. xvii+72, price £1 1s. net.

designed to describe and illustrate the flora of British Columbia, for the service of nature lovers, teachers and students, the author being Professor John Davidson of Vancouver, and the artist Miss Ivy Abercrombie. The book begins with a review of the characters determining the divisions and sub-divisions into which the Vegetable Kingdom is separated. Then come brief descriptions of the several groups of *Gymnosperms* with a more comprehensive résumé of the characters determining the *Coniferales*. The various genera and species found in British Columbia are then dealt with. Instead of keys, such as are often given with monographs of genera or descriptions of groups of species, the author gives very clear and useful analytical tables. He follows with a good description of each species, which includes scientific and common names, synonyms when necessary, and uses of the timber. There are 37 coloured or black and white drawings illustrating the 23 species of the 10 genera described. The drawings are very well done and they give full details of shoots, cones, and floral structure. Unfortunately the descriptive legends do not appear on the plates with the drawings but on thin covering sheets, which is certainly a disadvantage. The book is expensive for its size, and a less elaborately produced work would be just as useful and should meet with a wider sale, for a book designed for students and teachers should be reasonably cheap.

Bibliography of the Woods of the World.*—This bibliography is based on one prepared by Professor Samuel J. Record, of the Yale Forest School, the second edition of which appeared in 1923, and it is even now only a preliminary edition of a larger book that is to follow. It includes references to 1341 works on Trees and Timber, which are grouped in six divisions, General, Tropical America, Europe, Asia and Oceania, Africa, and an Index to Special Woods and Subjects. The Divisions Tropical America and Asia and Oceania are each divided into nine sub-divisions, the references to each division or sub-division being numbered. The Books are referred to under first the Author, then the date of publication, followed by title, publisher and number of pages. A limited number of copies has been published chiefly for distribution to institutions and individuals willing to assist in furnishing additional references for the fuller edition that is to follow.

* Bibliography of the Woods of the World (Exclusive of the Temperate Region of North America), with Emphasis on Tropical Woods. Prepared by the Tropical Plant Research Foundation for the Main Research Committee of the American Society of Mechanical Engineers, 1350 B. Street S.W., Washington, D.C.; A Revision and Extension by Major George P. Ahern and Miss Helen K. Newton of a Bibliography compiled in 1923 and 1924 by Prof. Samuel J. Record, Yale Forest School, Washington, D.C.

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